Reports – Miscellaneous. No. 9
Sanitation No 11.

MEDICAL ADVISORY COMMITTEE

MESOPOTAMIA INQUIRIES

(September 1916 to January 1917)

FINAL REPORT

(with general Index to all Reports)

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CONTENTS.

FINAL REPORT.

	Page.
1. Previous Reports and general subject index to the Series	1
2. Prevalence and Prevention of Disease in the Mesopotamia Force—General Observations	1
3. Medical Administration	3
4. Prevalence and Prevention of Particular Diseases	9
5. Miscellaneous outstanding points	19

APPENDICES.

I. Telegraphic Summaries of Previous Reports	23
II. Statistics of Sickness and Meteorology	25
III. Bacteriological Requirements	28
IV. Dysentery Enquiries	31
V. Enquiries as to Vaccines at Kasauli	32
VI. Agglutination Tests in T. A. B. Inoculated Cases	34
VII. Requirements of Cooking Areas	35

GENERAL INDEX TO ALL REPORTS.

MEDICAL ADVISORY COMMITTEE.

Mesopotamia Inquiries.

(September 1916 to January 1917.)

FINAL REPORT.

To

Surgeon-General F. H. TREHERNE, C.M.G.,
Director, Medical Services, Indian Expeditionary Force "D."

Sir,

We have the honour to submit a concluding report on our recent inquiries in Mesopotamia.

Previous Reports, and General Subject Index to the Series.

1. Our previous reports, which in consequence of our instructions were made at frequent intervals, have been as follows:—

Basrah . . .	conditions in	September 1916.
Sheikh Saad . . .	„	October 1916.
3rd Indian Army Corps .	„	October 1916.
Lines of Communication Sheikh Saad to Basrah .	„	November 1916.
Euphrates and Karun . .	„	Decr. 1916 and Jany. 1917.

For convenience, the telegraphic summaries which accompanied the above reports are reproduced below (Appendix I).

2. As these reports are now available in printed form, we have added below a subject index to the whole series, incorporating therewith references to the present report.

The series, of course, deals with the conditions met with at the time when the several inquiries were made, not necessarily with those which obtain at the present date, and the index consequently records a number of matters which were mainly of ephemeral or local interest. But it will also serve as a guide to the observations made and to the advice given in Mesopotamia, on a variety of questions which constantly arise in one form or another, and which remain important for the prevention of disease in this area of the war, notwithstanding such changes as may result from the rapid advance of the last few weeks and the capture of Baghdad.

Prevalence and prevention of disease in the Mesopotamia Force.

General observations.

3. During the second half of 1916 the total admissions for sickness of all kinds (*i.e.*, admissions to field ambulances and direct admissions to hospitals) were about 117,000,* The Medical Statistical Officer, General Headquarters,

*The approximate total admissions of wounded during the same period was 2,080. For the whole of 1916, the approximate number of admissions are stated to be—

Sick 207,000.
Wounded 23,300.

supplied us with the figures as to these admissions week by week summarised in Appendix I, which also gives a statement regarding the weekly admissions from specified diseases during the later months of the year. The latter must be taken with considerable reserve, owing to the uncertainty of diagnoses made on admission, and on this account probably underestimates the prevalence of certain diseases such as those of the enterica and dysentery groups. It will be seen that at the end of 1916 the rate of sickness in the Force from all causes had perceptibly fallen, as also the rates from certain individual diseases. The total sickness remained, however, considerable, at a rate which should be further reduced.

4. For the previous half of 1916 no corresponding figures were available. We have already referred (Report on 3rd I. A. C., paragraphs 52 to 66) to the great increase in sickness which began in April and continued during the hot months until July. If during the coming hot months the Force in Mesopotamia were to be attacked by sickness of the same nature and in the same ratio as in 1916, its prospects as regards efficiency would be extremely grave. When, however, we take a broad view of the work which we noticed during our five months in Mesopotamia we think it may be confidently expected that, relatively to the strength of the forces concerned, this degree of severity of sickness should not be approached in 1917.

5. This confidence is based, firstly as regards the medical service, on consideration of the good effect which has undoubtedly resulted, and which should continue to result, from the attention which has been given to the prevention of disease in all parts of the occupied area. To mention some only of the developments which came under our notice between the end of August 1916 and January 1917 :—

(*a*) *Personnel.*—Additional Deputy Assistant Directors, Medical Services, have been appointed for sanitary work. Sanitary Sections have been increased to 14, *viz.*—4 British and 10 Indian, of which 5 are with divisions and the rest on Lines of Communication or at the Base, 3 being allotted to Basrah (*cf.* Basrah Report, paragraph 18), and 1 sent to Kurna (Lines of Communication Report, paragraph 23). Active employment of specialist officers (*e.g.*, for malaria prevention, water purification) also of entomologists, now commissioned officers (*c.f.* 3rd I. A. C. Report, paragraph 47) Additions made to the staff of bacteriologists.

(*b*) *Field Sanitation* in its different branches has been greatly improved and made more systematic, particularly on the Tigris and Euphrates fronts—illustration of progress will be found in all our reports. Sanitation of river transports has received attention. Sanitary demonstration centre has lately been established at Basrah.

(*c*) *Laboratories* have been added to, redistributed, and their practical utility increased. Preparations have been made for further extending laboratory work as material, stores and subordinate personnel arrive.

(*d*) *Inoculation* with T. A. B. vaccine has been practically completed (at least for British troops); while anti-cholera inoculation has been general.

Many other examples could be given if it were necessary. It should be added that the great development of the military hospitals and improvements in the nursing and transport of sick, referred to below (paragraph 9) are also powerful factors in disease prevention—directly by reducing the chances of infectious or other sickness being contracted in the hospital, or on the river transports, and indirectly by enabling better diagnoses to be made and by affording opportunities for thorough treatment which prevents recurrence of attacks of malaria, dysentery, etc., when the man returns to duty. Important additions to, or improvements in, the isolation hospitals have also been made or are in progress.

6. Next as regards work, vitally affecting the health of the soldier, which during the period in question has been carried out mainly by the non-medical branches of the Army, we may cite such points as :—

(*a*) The remarkable and rapid improvement (amounting practically to reconstruction) of the whole river transport service, and all that this involves, especially in the way of regularity and speed in obtaining supplies of all kinds.

(*b*) The opening of the railway from Basrah to Nasiriyah at the end of the year, and the extension and development of the Tigris lines. These, in addition to increased motor transport, will have similar results.

(*c*) Improved rations, and development of local food supplies, especially locally grown vegetables.

(*d*) Increase in available hutting for troops at the base, and in available supplies of double fly-tents and many other hot weather requisites for camps in advanced areas.

(*e*) Practical completion of the temporary water supplies at Basrah (Basrah, Report paragraphs 22—26); arrival of filtration plants. Improvements in certain local water services up-river. Methods of chlorinating water have been systematised.

(*f*) Other sanitary works, *e.g.*, reclamation, drainage and bunding at Basrah, Amara and other base areas, are making progress or have been started.

7. The above, among many other changes, collectively entail much better conditions of environment for the troops, and their benefit can hardly fail to be shown in increased health and efficiency. Other considerations point to the same conclusion. Steps have been taken by the Army Commander as far as possible to avoid the sending of troops direct from England to Mesopotamia in the hot weather, and to provide for leave being given to men who have already had a long period of duty in the country. The arrangements for the collection of followers before leaving India for Mesopotamia, and their medical examination—both very important as regards preventable sickness—have lately received special attention.

8. At the same time, it must be realised that even at the present favourable time of the year, the Mesopotamia War Area is by no means free from sickness, and, though there is every reason to anticipate great improvement on the record for 1916, a conspicuous rise of sickness from various causes with the onset of the warmer weather must be expected.

In this report we propose briefly to deal with points relating to the occurrence and prevention of sickness on which we lay special stress, or on which it seems desirable to supplement previous reports. They fall under the following general heads :—

Part 1.—Medical Administration.

Part 2.—Prevalence and prevention of individual diseases.

Part 3.—Miscellaneous outstanding points.

Part I.—MEDICAL ADMINISTRATION.

Comparison of Progress in provision for treatment and that for prevention of disease.

9. The progress which has been witnessed in Mesopotamia since last summer in all matters relating to hospital accommodation and the transport and treatment of sick and wounded has been most striking. At Basrah, Amara and elsewhere new hospitals for British and Indians have been provided, while existing hospitals have been largely reconstructed; hutting, suitable

for hot weather, has been put up on an extensive scale, hospital areas have been bunded and drained, provision has been made for electric fans and light, ice-making and other requisites; medical and nursing staffs have been increased. The divisions in the advanced area are well equipped, each with five combined field ambulances. The river sick convoy arrangements have been greatly improved, and excellent hospital trains from India have now arrived. The equipment of the various medical units has had close attention, and generous support has been received from voluntary agencies in India. The results as a whole must be highly gratifying to all those in Mesopotamia, India, and at home who have laboured so unceasingly to produce such a high standard of organisation and preparedness.

10. Meanwhile methods for dealing with the prevention of sickness have also made much satisfactory progress, in the directions above referred to. The attention given to the organisation and perfection of the preventive side of the work has not, however, in our view been equal to that bestowed on the provision made for dealing with sick and wounded, and it is important to balance this inequality.

11. It may be helpful if, on conclusion of our inspections, we indicate the main directions in which the organisation of the preventive work seems to need further development at (1) Headquarters, (2) in the field units, and (3) at the base, and other important centres. We assume that a force of about the present magnitude will be continuing to operate in, or to be in occupation of, Mesopotamia during the present year; no other assumption, naturally, is open to us.

Headquarters.

12. We would invite reference to the various headings in the subject index to our reports attached below. These indicate some, but by no means all, of the questions of preventive medicine which the headquarters medical staff must constantly have under review. They have not only to be satisfied that, as regards the force as a whole, all practicable steps have been or are being taken for general measures of sanitation, for special methods of preventing particular diseases, or for the intelligence and educational work on which so much depends if efficiency is to be secured. They have also to consider the directions in which preventive work can be simplified or expedited by prompt action and initiative from headquarters, or in which it needs to be co-ordinated from the centre.

13. This branch of the central work is no doubt at present carried on to the maximum extent that is possible to the Director, Medical, Services with the many other and pressing calls on his time, and with the limited special staff at General Headquarters represented by the A. D. M. S. (Sanitary), and the D. A. D. M. S., detailed for medical statistical duties. The special difficulties necessarily entailed by the fact that his office, with that of the A. D. M. S. (Sanitary), has in recent months been up-river have also to be remembered. We are, however, strongly of opinion, as a result of our visits to all parts of the wide area over which the troops are distributed, that on the preventive side the central organising and directing work should be further developed and we make suggestions for this purpose below.

14. We noticed many instances in which there would have been great advantage in a timely reminder or lead from headquarters as to special preventive measures needing immediate general attention or adoption, or requiring to be systematised. We were impressed also with the frequent need for general distribution to medical officers in the force (especially on arrival in Mesopotamia) of information on such matters as the following:—suitable contrivances for field sanitation; the extent and nature of prevalent epidemic disease; points on diagnosis and treatment of preventable diseases with which medical officers from home are unfamiliar; the system to be followed in arranging for inoculations, quinine prophylaxis, malaria prevention, post-malarial treatment, heat-stroke, and the like; and the co-operation which is necessary between hospital medical officers and laboratories if the work of the latter is to be turned to its best practical account. Not infrequently a definite order or instruction from

headquarters, systematising the whole matter, would have been of great advantage. In other instances it was often evident that much good might have resulted from a visit of inspection by an officer from headquarters, familiar with the preventive work done in other Mesopotamian areas and able to speak with authority and start necessary action on right lines.

The initiative and authority of the Assistant Directors, Medical Services, of divisions and base areas need in no way be lessened by such central action : on the contrary they should be increased, as these officers would have better knowledge of the requirements and experience of the force as a whole.

15. Save in the 3rd Indian Army Corps in October, where to a large extent the co-ordinating and supervising work required had been carried out by the Assistant Director, Medical Services (Sanitary), of that corps, we were often struck by the fact that in our visits the same question of principle or practice had to be discussed or explained in one area or unit after another, and the same advice repeated with wearisome iteration. Our reports and other communications to the Director, Medical Services, have been made largely with the object of facilitating the central action in such matters which seemed so desirable, and we are glad to note that circulation has already been given to certain of the suggestions and memoranda which we have forwarded. Obviously, however, the question involved is one of ordinary daily administration, which can be better guided and dealt with by men who are part of the regular administrative machine than by a visiting committee without executive functions. It is of course important that the results of headquarters' advice should be watched and followed up, and the observance of orders supervised ; such matters are outside the province of an advisory committee.

16. Preventive medical work in Mesopotamia is of such importance and calls for such a high degree of administrative capacity and attention to detail that we think that the officer who assists the Director, Medical Services, in this branch should be a Deputy Director, Medical Services, with his office at or near the base (Basrah or Amara).

17. This officer should be charged with the organisation of all measures for the prevention of disease, be in direct touch with all administrative medical officers and with the heads of other departments, deal with questions of sanitary personnel, and be given a small staff of inspecting officers of field rank, with special experience of, or aptitude for, the kind of co-ordinating and supervisory work which is required. We believe that suitable men could be found for the purpose in Mesopotamia or in India.

18. He should also have on his staff a chief or consulting bacteriologist, who would co-ordinate the work of the various laboratories, see to the collection and utilization of laboratory results, and arrange for laboratory supplies and equipment. We drew attention to the advantage of such an appointment shortly after our arrival in Mesopotamia (*cf.* Appendix III below) and subsequent experience has added to our sense of its practical importance. The chief bacteriologist, or another officer specially detailed for the purpose, should also have the duty of keeping account of the progress and records of all preventive inoculations in the force, and the evidence as to the protection afforded, and he should advise as to the periods and occasions most suited for general inoculations or reinoculations with enteric or cholera vaccine.

19. Expert workers, including those now on the staffs of the Central Laboratories and also the medical statistical officer already come, for purposes of establishment, etc., under the central D. M. S. office, which should be in a position to make the fullest use of their services for practical administrative needs. The system of securing highly qualified expert officers for special subjects such as malaria prevention, water purification, protozoology, entomology and chemical analysis is excellent. All these officers have done most valuable work, and their usefulness would be further increased by measures, such as above proposed, by which they would be brought still more closely into touch with the everyday working requirements of the force, and the results of their investigations would become better known.

20 We have already referred to the importance of developing intelligence work, which would probably entail some additional arrangements for clerical assistance and certainly should be accompanied by securing the best available means for rapidly printing or copying short documents and memoranda. A short printed document issued for general circulation to all medical officers of the force would frequently be much more effective than a system of sending communications which have to be recopied at many different points if they are to reach the medical officers of regiments, hospitals or laboratories who chiefly need the information.

The central office should, we think, supply the Assistant Directors, Medical Services, with the weekly statistics collected at headquarters regarding the prevalence of infectious diseases in the force; a matter on which at present very little information is given out.

Field Units.

21. Looking back on our inspections we cannot fail to recall the many occasions on which we found the sanitary conditions of camps and camping grounds just being got into better order, although they had been occupied for considerable periods. Admirable work was in progress, but it was obviously being undertaken too late, and mischief had meanwhile been done. We do not wish to labour the point, but draw attention to two considerations which arise from it.

22. The first is that often little reliance can be placed on the regimental medical officer in matters of sanitation. In theory, the medical officer of a regiment, or corresponding unit, is a most important part of the organisation for the prevention of disease. He should deal with such daily requirements of the unit as its observance of sanitary discipline, the provision or improvisation of latrines, cookhouses, messing places, water distribution, the cleanliness of food preparation, avoidance of flies, and questions of cooking, inoculations, rations and clothing, etc. On all these subjects, and many more, he should have the ear of the commanding officer and constantly strive to keep the unit healthy. In practice, we have met some regimental officers who work hard with these objects in view, and with excellent results. But they are exceptional; it must be recognised that most of the medical officers now posted to units (both British and Indian) naturally have little experience or knowledge either of applied hygiene or of military life, which would enable them to take effective action in these directions, and that many have no great aptitude for this class of work. No doubt the keener men improve under instruction from the A. D. M. S. or the D. A. D. M. S. of the Division or by hints from the Divisional Sanitary Section. But the instruction required is in details as well as in outline, and the process is a slow one, especially when forces are widely scattered, as is often the case, and the visits of the divisional officers are infrequent. Moreover, owing to the expiration of contracts, sickness and other causes, unit medical officers very frequently change.

23. The second is the need for speeding up and improving the minor constructional work and local sanitary supervision which mean so much to the health and comfort of the unit, and which it is so necessary to get going at once when new ground is occupied, even for quite short periods. It is noteworthy that under two circumstances this work is almost invariably well done from the start (*i*) at the headquarters of a division, when the area occupied is dealt with directly by the divisional sanitary section, and (*ii*) at field ambulances. The reason is simple; the work is undertaken on the spot by men who know what is wanted, how to get material, and how on occasion to improvise without material. They have not to wait, as is elsewhere often the case, for untrained men to be spared from other work, or to waste time in building latrines, incinerators, cooking shelters and the like which are unsatisfactory and have subsequently to be reconstructed after their defects have become only too obvious.

24. We think it well to draw attention to these points so as to emphasize the importance of meeting them to the greatest extent that present conditions allow. Probably they could only fully be met by a considerable reorganization of sanitary units. It would not however be advisable for this Committee to make definite recommendations for such reorganization without further information than we possess as to the military questions involved in Mesopotamia at the present time.

The result to be aimed at may, however, be illustrated by making the assumption that no difficulty would arise in obtaining the additional medical officers and other medical reinforcements required for the purpose. In such case, consideration might be given to a new scheme for working field sanitation which would allot to each brigade, or to the equivalent of a brigade, a medical officer specially charged with all the preventive and sanitary work in the constituent units, responsible for them to the Assistant Director, Medical Services, of the division, and in touch with the central sanitary staff to which we have above referred. The number of medical officers required for this purpose would be comparatively small, and could apparently be made up in the first instance by promotion of good men from regiments or field ambulances, the vacancies being filled up from the reinforcements camp. This brigade medical officer should also be in command of a small unit, organised and equipped more or less on the lines of the present "combined" Sanitary Section, for the general sanitary work of the brigade. These new sanitary units might be raised and trained at the base mainly from British medical orderlies and Indian medical personnel in much the same way as other new specialized units have been created during the war. Such instruction might easily be developed at the excellent sanitary demonstration centre which has been arranged at Makina and is worked by the 46th (British) Sanitary Section. In the first instance a useful nucleus for the new units could probably be obtained from field ambulances where many of the rank and file are already well acquainted with the work required.

25. Any improvement in medical organization for field sanitary work should fully maintain the principle of the responsibility of commanding officers for the sanitation of their units and should help to make it more effective in practice. Although exceptions were met with, we found that, as a rule, commanding officers realised the great importance of these responsibilities and not infrequently themselves closely supervised details of field sanitation. We had striking evidence also of the good which results when officers in the higher commands insist on the maintenance of sanitary discipline; the value of such action to the health of the army can hardly be overestimated.

Basrah and other important centres.

26. In these large areas the Assistant Director, Medical Services, has control of and responsibility for a great hospital organisation in all its bearings, as well as arrangements for embarkation of sick, allotment of medical personnel and a large number of other duties. To these are added work for prevention of disease among the large fluctuating military populations in his area, and various questions of "sanitation," which in Basrah and Amara include difficult problems arising from the contiguity of military and native populations, from the rapid growth of imported labour of all kinds, and from daily changes in the number and personnel of the troops in the area. The Assistant Director, Medical Services, has assistants for various branches, including a D. A. D. M. S. (Sanitary), and sanitary sections. The system is not necessarily opposed to the best development of preventive work, and from the Army point of view is no doubt preferred to one which would divide the duties between officers of equal position, the one dealing broadly with all questions of hospitals, transport of sick, medical stores and general arrangements for treatment, and the other with all measures for the prevention of disease, including those which usually come under the term "sanitary."

Under the present system, however, the principle to be recognised is that in a great base area and other occupied towns in a country like Mesopotamia the work required for the prevention of disease is in no way secondary in importance to the other duties of the Assistant Director, Medical Services. It is indeed

the most important of all, and it requires the almost undivided attention of one administrative head. The Assistant Director, Medical Services, may be able to give this attention by liberal devolving of other work, but should this not be done the devolution of preventive work to the Deputy Assistant Director, Medical Services, concerned should be thorough and effective, and there should be no question as to the authority and responsibility of this officer in dealing with all branches of preventive work, including the control and direction of the sanitary sections. We did not regard the position in Basrah as satisfactory in this respect at the time of our departure and draw attention to the matter as the healthiness or otherwise of this base during the coming months will be of the utmost importance to the force as a whole, and any remediable defects in its sanitary organisation should be removed. In this connection we again would draw attention to our observations in paragraph 19 of the Basrah report.

Recognition of sanitary service.

27. Independently of the suggestions in the above paragraphs, though the subjects are closely connected, we would urge that preventive medical work, whether in the field or the laboratory, should be invested with greater official importance than it possesses at present when compared with other branches of the medical service. In war men are naturally influenced by ambition for tangible marks of success in the form of honours, promotion in rank, or advance of pay. In Mesopotamia, as unfortunately sometimes in other war areas, specialising in preventive medical work whether at the front or elsewhere is by no means the best road to advancement in any of these directions.

It is hardly desirable that we should here cite the cases of individual officers which we have in mind but we would express the hope that meritorious and highly responsible services in this branch of the work should be at least as fully recognised as in other branches by permanent or temporary increase in rank, by equivalent gradings for purposes of pay, and in other ways, wherever it is evident that such recognition would increase efficiency.

Medical Reinforcements.

28. The constant changes which have taken place, mainly from sickness and from other unavoidable causes, have been a source of much difficulty. Some instances came to our notice in which new medical officers arrived at Basrah with a very few months to run before their military contract expired and they returned again to England. Little good can be expected from short service of this kind. Every effort should be made in England to secure for Mesopotamia men without ties which compel their return as soon as they have a choice in the matter. In Mesopotamia cases sometimes occur in which it would appear possible to retain useful men by modifying the ordinary rule or practice in regard to leave, promotion and renewal of contract.

29. The advantage of obtaining medical officers who have practical experience of tropical diseases is so great that all possible efforts should be made to secure any such officers for Mesopotamia who may now be on military duty, or available for military duty, at home or in France. It has been suggested to us that further inquiries for this purpose might usefully be made.

30. Medical officers leaving England for Mesopotamia should be encouraged to take with them books of reference, and microscopes if they have them; and, if likely to be employed on special work, (*e.g.*, in the laboratory) to bring out reasonably portable articles which will be of use in that work. There should be no difficulty, with the present rail and river transport service, in arranging for temporary storage of such articles on occasions when officers have to lighten their kit.

Part II.—PREVALENCE AND PREVENTION OF PARTICULAR DISEASES.

In addition to observations regarding individual diseases in previous reports (*vide* index), the following points seem to require brief notice here :—

Cholera.

31. The satisfactory fall in the prevalence of cholera (Appendix II, Table 5) may, apart from climatic conditions, be attributed in large measure to the improvements in water supplies and in field sanitation above referred to, and in part to the anti-cholera inoculation which has been carried out. The duration of the protection afforded by this inoculation is usually considered to be about three or four months only. Judging from last year, the months from April to September are favourable to epidemic cholera, and most of the force in Mesopotamia will need to renew and complete their inoculation protection before that period. Labour and Porter Corps leaving India for Mesopotamia are being inoculated against cholera before their departure: the practice should be continued during the coming months.

32. We would suggest arrangements for a rapid general re-inoculation of the force—certainly of that part in the advanced area—at an early date, not later than the end of April. By adoption of a standard routine (*cf.*, paragraph 14) we believe greater expedition could be secured than was the case last year.

33. In this and other inoculations the rule of entering the fact and date of inoculation (and in the case of ordinary vaccination the local result also) in each man's pay-book should be strictly complied with by all medical officers. It would be useful if, in the future printing of the paybooks, spaces with appropriate headings for these entries were arranged for. The nature of the pay-book entry should always be recorded in the hospital notes of any patient suffering from one of the diseases in question.

34. The present dose of cholera vaccine (4,000 million in the double inoculation) is on the small side. The reactions which follow anti-cholera inoculation are very slight, causing little or no interference with duty, and we have no reason to apprehend that the case would be different if a larger dose is given. We have conferred on the matter at Kasauli with the Acting Director and other officers of the Central Research Institute where the vaccine is made, and have suggested the immediate preparation of a new vaccine (12,000 millions in the double dose) for transit to Mesopotamia as soon as possible after the necessary trials with it have been made in India. The nature of the trials desired, together with certain other technical questions regarding the preparation of this and T. A. B. vaccine (see below) were discussed at Kasauli, and a memorandum on the question (Appendix V) has been forwarded to the Director, Medical Services, India, and the Director-General, Indian Medical Service. Authority has already been given for the preparation of the new vaccine, with a view to its issue, subject to the result of the trial, on the above lines.

Plague.

35. The presence of rat-plague in Ashar and other parts of the Basrah area has for some time been established, though, so far, there has been relatively little spread of the disease either to the military or native population (Appendix II, Table 5), and no British cases have occurred. The precautions taken to prevent the landing of plague-infected rats from ships arriving from Bombay seemed to us to need strengthening. The matter was discussed with the Assistant Director, Medical Services, Bombay, who is making arrangements to secure more systematic rat destruction on transports, and more effective rat catching at the docks where stores for Mesopotamia are loaded.

Smallpox.

36. The inactivity of some of the vaccine lymph in Mesopotamia (*cf.* Euphrates, etc., report, Appendix III) is probably related to the system by which it has been sent from India and distributed in Mesopotamia without adequate precautions for keeping the lymph cool. The lymph itself is obtained from the Government Vaccine Depôt, Lahore, and is reported to be satisfactory. We have called attention to the matter both in Mesopotamia and in India, and the arrangements now being made should ensure its through transit in the cold.

Enterica.

37. For reasons above indicated (paragraph 3) the actual prevalence of the diseases in this group is probably considerably under-estimated in the figures in Tables 3 and 4 (Appendix II) which are based on official returns representing diagnosis in the hospital unit to which the case is first admitted. For example, many mild cases of Enterica have been returned as "Sandfly fever", as "P. U. O." or as Malaria. For the reduction of this disease group, particularly important in the coming months, reliance must be placed both on obtaining the highest possible standard of field sanitation and on the use of the specific vaccine. At the present time there are wide variations in the period which has elapsed since the triple (T. A. B.) vaccination was performed, although a considerable majority of British troops must have received and completed their T. A. B. inoculation within the last five months. There may, however, be units in which there has been no recent overhaul, and in any case all unit medical officers should see that they have at the present time no outstanding cases of men needing and ready to accept T. A. B. inoculation.

38. We consider that a general ino culation with T. A. B. throughout the force should be arranged for in the autumn.

39. Paratyphoid A is much the most common form of enterica infection in Mesopotamia; roughly, from the experience of different hospitals and laboratories, the percentage occurrences of typhoid, para-A and para-B (blood culture cases) appear to be 20, 70 and 10 respectively.* Various facts point to the conclusion that the degree of protection against para-A afforded by the "A" constituent of the T. A. B. vaccine has been less than that which a typhoid vaccine, or the "T" constituent of T. A. B., confers against typhoid, but these do not permit any very confident assertion to be made, and it is quite impossible, from any data obtainable in Mesopotamia, to put the matter to a numerical test.

T. A. B. inoculations in Mesopotamia are carried out with vaccine prepared at Kasauli and given in the same volumes ($\frac{1}{2}$ c. c. followed by 1 c. c. the following week) as are used in corresponding inoculations with Millbank vaccine in England, France and the Mediterranean war area. The strength of the vaccine however, is halved, the total for the two inoculations being (in millions) :—

	Typhoid.	Para-A.	Para-B.
Kasauli	750	562	562
Millbank	1,500	1,125	1,125

The difference was made with the object of reducing the reaction of the vaccine, in view of the climatic and service conditions in India and Mesopotamia.

After our visit to Kasauli (paragraph 34 above), when the matter was discussed in all its bearings, we would advise :—

(*a*) the preparation, for use in the suggested general inoculation at the end of the hot weather, of a T. A. B. vaccine with the following bacterial strength in the two inoculations :—

Typhoid.	Para-A.	Para-B.
1,500	1,500	750

*It is of interest that of 74 carriers detected at the Naini Tal and Wellington enteric depôts in 1916 59 were carriers of para-A. The total carriers detected formed roughly 4 per cent. of the cases examined at these depôts.

(*b*) Immediate preparation of a stock of this new vaccine sufficient (1) for the necessary preliminary trials in India and (2) if the result of these trials be satisfactory, for use in Mesopotamia, before the hot weather, in outstanding cases which have escaped T. A. B. inoculation or where only a single inoculation has been done.

40. Copy of a note forwarded to the Director of Medical Services in January, explaining the reasons of the Committee's advice that agglutination tests should be abandoned in T. A. B. inoculated cases is appended below (Appendix No. VI).

41. In India, we have obtained information regarding the practice of dealing with Mesopotamian convalescents from diseases of the enterica group at the Indian enteric depôts (Parel, Naini Tal and Wellington) in order to detect and eliminate carrier cases, and we have at the request of the Director, Medical Services, India, made recommendations which are as follows:—

The examination of carriers at the enterica depôts under present war conditions should be carried out under the direction of the chief bacteriologist of the depôt in whatever manner he considers most effective for the detection of carrier cases consistently with the general principle stated below. No routine number of examinations is prescribed, but they should in no case be less than 7. No certificate that an officer is not a carrier should be given unless at least this number of examinations has been made.

The general principle which should govern the practice of the depôt in regard to cases from Mesopotamia is that passage through the depôt forms part of a system under which healthy convalescents are to be actively prepared for return to service in the matter of diet, exercise, etc., at places suitably situated as regards climate or presenting other advantages for the purpose.

At the depôt:—

(*a*) This preparation is continued.

(*b*) Carrier cases are detected to the greatest extent possible within the period of stay allowed.

(*c*) The period of stay should not (ordinarily) exceed five weeks.

In other words, the depôt during present war conditions is not to act as an institute in which every man must be kept until the bacteriologist is satisfied, after the most rigorous and sustained examination, of the complete absence of any risk of the carrier condition, but it will act as an institution in which the bacteriologist aids, to the maximum extent possible in the allotted time, in the detection of carrier cases. A certain leakage may be accepted as a practical necessity. Experience has shown that the conditions above specified will enable a large majority of the carrier cases to be detected, including those in which the excretion of bacilli is most intense and continuous.

42. In this connection it is of the first importance that the hospitals and depôts in India should have the fullest possible information as to the clinical history, bacteriological results, and treatment of all cases in the enterica group arriving from Mesopotamia. We have already (*vide* Index: Hospital Notes) pressed for improvements in the method by which such notes accompany the case through the different hospital units in Mesopotamia. An order to the Basrah hospitals, recently issued, should ensure that on the further journey to India each convalescent enterica case has his case records with him. These should be obtained and used at the Indian hospital or depôt where he is received.

Dysentery.

43. The work which was set in hand in September (Basrah report, paragraph 56) to ascertain the nature of prevalent dysentery has been completed and its main results are summarised in Appendix No. IV below. The investigation was carried out in the laboratory of No. 3 British General Hospital, Basrah, on the bacteriological side by Captain Boney, R.A.M.C., and on the protozoological by Lieutenant Boulenger. Corporal W. J. Muggleton, who

came with our Committee from Egypt, where he had a large experience of the technique required, was lent to the laboratory for five months to aid in this investigation, for which his services were invaluable.

Both bacillary and amœbic dysentery were present, but the former (chiefly associated with *B. Shiga*) has evidently preponderated; in the proportion roughly of 3 to 1.

44. Dysentery from both causes has been and remains a very serious factor of sickness in the force, Indian as well as British, and has been responsible for much diminution in strength and loss of efficiency. Its prevalence is one of the chief reasons for representing, in and out of season, the great importance of attention to daily details of field sanitation, especially those for securing the cleanliness of food and the avoidance of fly-infection. In all our local inspections we have laid much stress upon this aspect of its prevention, and also have inquired closely into methods of treatment and diagnosis, the co-operation in this respect between hospital and laboratory officers, and the precautions against infection which were taken at different stages, and we have made numerous suggestions for improvement (*vide* Index).

45. A notable improvement in the treatment of dysentery has been observed in the dysentery sections of certain of the large general hospitals, where the medical officers concerned are genuinely interested in the subject and avail themselves of all the laboratory aids at their disposal. The fullest co-operation between clinician and bacteriologist conduces very materially to the rational treatment of this disease and it would be invaluable, from a practical standpoint, if medical officers working in such sections were encouraged to collate and analyse data on the effect of various specific and non-specific treatments especially in hastening recovery and shortening the period of convalescence. For this purpose a fairly large series under each treatment or modification of treatment would require to be kept under observation, and the work should have reference to the results of different treatment on all the important manifestations of the disease, not on some one symptom only. Periodic reports on the progress of any such work should be made to headquarters.

46. *Bacillary Dysentery*:—We have pointed out the importance of early and free use of anti-dysentery serum in severe and toxæmic forms of the disease—for example 60 to 70 c. c. at once, and if necessary intravenously. The serum might be similarly used with advantage in less acute cases, and this should receive attention in the inquiries referred to in the last paragraph. It is probable that by the early administration of serum in comparatively mild cases, the duration of invalidity and of convalescence may be materially reduced. Administration of serum should not be withheld pending the receipt of laboratory reports in cases where it appears to be needed on clinical grounds.

We have discussed at Kasauli the preparation of a mixed anti-bacillary dysentery and cholera vaccine. In view of the recommendations made above regarding other inoculations, we do not advise the immediate general introduction of such a vaccine, but consider that its preparation and a trial on a limited scale, which a view to its possible issue later on, would be desirable.

47. *Amœbic Dysentery*:—Different combinations of emetin including the bismuth emetin iodide, have lately been recommended in substitution for ordinary emetin, but on present information we think it will probably be best to maintain emetin itself as the standard drug for ordinary use, given in the doses recommended in our Basrah Report.* Special care should be taken that the patient on leaving the hospital has with him a record of the dates and doses of emetin administration.

We have arranged for circulation in Mesopotamia of a summary of Lieutenant-Colonel Wenyon's report to our Committee on the results of the investigations which he carried out at Alexandria into the prevalence and

*The minimum treatment recommended (with a view to the prevention of relapse) was one grain a day for 12 days by injection accompanied by one additional half grain of emetin, preferably in keratin coated tablet given each night by the mouth. This method, tested in Egypt, has given results which are comparable to those obtained with bismuth emetin iodide and detailed in the War Office Memorandum of January 1917, recently come to hand.

persistence of *Entamœba histolytica* in cases of acute and chronic dysentry, in convalescents and in healthy men, and on the result of administering emetin to dysentery and carrier cases. From the Egyptian experience it may be inferred that in the Mesopotamia force, both British and Indian, there are numerous healthy carriers of *Entamœba histolytica* (in the Egyptian series they were above 5 per cent.), and such few observations as have been made on the matter in India and Mesopotamia point to the same conclusion. This consideration should be kept fully in mind when proposals are made for detaining dysentery convalescents for long periods before returning them to military duty in order to be satisfied that they have ceased to be carriers The essential criterion on which return to duty is decided should be the physical fitness of the men and the absence of evidence of recent relapse. This statement applies even more strongly to the various flagellate infections, the mere presence of which apart from clinical symptoms, may for practical purposes be ignored.

Cerebro-spinal Fever.

48. This disease was prevalent to a very small extent during our visit to Mesopotamia, but a number of cases are now being reported. We advised that a good stock of anti-meningococcus serum should be obtained, and that it should always be promptly used when the clinical evidence points to the diagnosis of cerebro-spinal fever, without necessarily waiting for bacteriological confirmation.

As regards prevention, we do not consider that a thorough and systematic search among all possible "contacts" for the detection of carrier cases (such as has been carried out at home) would be practicable under the conditions in Mesopotamia. Partial and incomplete measures for this purpose would usually be of little practical advantage and might do harm by compelling the bacteriologist to neglect other important duties.

In units where the disease occurs it is of course important to secure the freest possible degree of ventilation of huts or other quarters, and to prevent the spread of infection through men using the same drinking vessels, pipes and the like. It has been suggested to us that in regard to this and some other diseases the issue of short explanatory hand-bills or posters would be useful, at least for British troops.

Malaria.

49. Little need be added to what has been said in the other reports regarding malaria and its prevention. Malaria, one of the most important of Mesopotamian diseases, has been most in evidence, as a locally acquired infection, at Basrah and Kurna. It may occur wherever certain anophelines, and more especially *Anopheles stephensi*, are found in any numbers. Malaria is likely to be more prevalent in Basrah during 1917 for the bunding and other engineering operations have in many places rendered the irrigation channels more suitable as breeding places for anophelines and the outlook is serious unless prompt and effective action is taken.

Major Christophers in his Annual Report on Malaria for 1916 tabulates the Mesopotamian anophelines as follows :—

Anopheles pulcherrimus.	Theo.
Anopheles stephensi.	Liston.
Anopheles sinensis.	var. *Mesopotamiae* Christophers. var. *vanus* Walker.
Anopheles lukisi	Christophers.
Anopheles nursei	Theo.

To these must be added *Anopheles maculipennis*, Meig. a well-known malaria vector in Europe, a single specimen of which was taken by Lieutenant-Colonel Wenyon at Arab village in October 1916.

As Major Christophers has pointed out, *Anopheles stephensi* is the chief malaria carrier of the above group so far as Mesopotamia is concerned. *Anopheles pulcherrimus*, though very numerous in certain places and at certain seasons, does not appear to be an intense carrier. *Anopheles sinensis* is a swamp mosquito; its exact relationship to malaria infections remains undetermined, but is probably slight, if indeed it exists. *Anopheles lukisi* and *Anopheles nursei* are too rare and limited in distribution to be of any practical importance. The same is probably true of *Anopheles maculipennis*.

50. A point of considerable interest is that, contrary to the statement made in our Basrah report (paragraph 55), a statement founded on the view expressed by Major Christophers, locally acquired malaria does occur in certain parts of the base area throughout the winter months (October to March). We understand that Major Christophers has, as the result of more lengthy experience, somewhat modified his opinion on this matter. The Committee before leaving Basrah in January 1917 instituted an enquiry into the occurrence of recent primary cases of malaria and obtained admission rates from the British General Hospitals. Save in the case of No. 33, British General Hospital, the returns are so small that they need not be here considered. They showed that the amount of primary infection occurring during the winter months in the Magil Area and in the neighbourhood of No. 3 British General Hospital was negligible.

The returns from the No. 33 British General Hospital, which admits from the Ashar and Makina districts, are, on the contrary, distinctly suggestive and are here recorded:—

—	Ashar.	Makina.	Other Areas.	Total cases admitted.
November 1916 . . .	78	37	6	121
December 1916 . . .	48	18	17	83
January 1st-15th, 1917 . .	14	11	3	28
Total .	140	66	26	232

Primary infection is said to have been established in 108 of the total cases while 73 were relapses. In the remainder it was not possible to ascertain whether the infection was primary or secondary. In 90 per cent. of the primary cases the infection is stated to have developed after a residence of three weeks or longer in Mesopotamia. It is, of course, often difficult to be sure that a malarial infection has actually been acquired locally but the above records would undoubtedly seem to show that a certain amount of primary malarial infection does occur in Ashar and Makina Area. At the same time a mosquito survey made by Major Christophers and Lieutenant-Colonel Wenyon in Ashar in January failed to reveal the presence of adult anophelines in the barracks and elsewhere.

51. As regards malaria prevention we desire strongly to support the proposals put forward by Major Christophers in his Annual Report for 1916. We hope that the measures he advocates will be at once sanctioned and put in force. Any delay may prove fatal to the success of his scheme which we are convinced is an absolute necessity if malaria is to be kept under control during the coming spring and summer.

Major Christophers' proposals have been framed on the following considerations:—

(1) The necessity of acquiring a thorough knowledge of the local conditions governing malaria prevalence in Mesopotamia and more especially of the distribution of dangerous anophelines and of the amount of malaria amongst the native population. This is part of the survey work which he himself undertakes, and he requires an assistant investigation officer to aid him in his enquiries.

(2) While, in many localities, it is impossible to carry out anti-mosquito measures upon a large scale, there are certain parts of the base area and of Kurna where a limited but properly conducted campaign directed against mosquito breeding places would in all probability materially diminish the amount of malarial infection. Begun on a small scale such measures could be extended and improved as required. For this purpose there is needed at Basrah an officer of wide experience provided with a sufficient staff to enable him to carry out the necessary survey work, to maintain a watch over the area, and to take urgent action on a small scale when necessary. He should be on the spot at an early date in order to get his preliminary surveys completed.

(3) Quinine prophylaxis to be effective requires the most careful and expert supervision. Otherwise it is too often a mere waste of time and money and engenders a false sense of security. Properly carried out, it is a valuable method of preventing infection and lessening the number of malaria carriers but it should be under the immediate control and supervision of a medical officer fully conversant with what is required, to render it successful. Such an officer is provided for in Major Christophers' scheme and it is most important that he should be appointed before the malarial season commences.

Major Christophers advocates a daily prophylactic dose of five grains of quinine. We would prefer, if it is feasible, that the dose should be at least six grains and we understand that Major Christophers recognises that this would be an advantage as far as the efficient action of the drug is concerned. Other matters to which we would again draw attention are :—

(*a*) The systematic use of larvivorous fish, especially at Basrah, and the employment, if necessary, of pisciculture in this connection.

(*b*) The employment of mosquito trap-pools in the neighbourhood of land irrigated for cultivation as at Amara (see Lines of Communication Report, Appendix VII).

(*c*) The necessity for a systematic inspection and repair of mosquito nets, together with an elimination of all nets with less than 18 meshes to the linear inch or which are in other ways unsuitable, *e.g.*, through lack of a calico strip round the foot or wrong shape. These duties might suitably be entrusted to the officer controlling the quinine prophylaxis.

(*d*) The possible value of spraying as a means of killing adult and often infected anophelines in certain places. If for any reason Lefroy's anti-fly spray proves unsuitable, one or other of the following solutions may be tried—

(*a*) $2\frac{1}{2}$ per cent. solution of potash soap ;

(*b*) a solution of 3 drachms of medical soda soap, in $1\frac{3}{4}$ pints of water containing 11 drachms of formalin. The smell of the latter can be removed by allowing ammonia to evaporate.

52 Lastly we would again refer to the great importance of instituting and maintaining the adequate post-malarial treatment so frequently mentioned in our other reports.

In this connection the following table, submitted by the 40th British General Hospital, Basrah, speaks for itself :—

MALARIA (*Recurrent*).

Date of 1st attack.	Place of 1st attack.	Present attack.
1 February 1916	Kurna	4th Attack.
2 „ 1914	India	7th „
3 August 1916	Ashar Barracks . .	3rd „
4 June „	Persian Gulf . .	2nd „
5 July „	Basrah City . . .	5th „
6 Ditto	Ess Sinn . . .	4th „
7 Ditto	Amara . . .	4th „
8 „ 1912	India	12th „
9 „ 1916	Khamisiyeh . . .	5th „
10 „ Ditto	Ashar	6th „
11 „ Ditto	Near Kut . . .	3rd „
12 „ 1915	Amara . . .	10th „

The above gives some idea of the great amount of preventable invaliding from this cause and it is to be hoped that, as far as possible, the recommendations we have made in this connection will be carried into effect.

SCURVY.

53. At the instance of the Committee, observations have been made by Lieutenant-Colonel J. L. Marjoribanks, I. M. S., as to the physical condition of reinforcements from various parts of India on their arrival at Basrah, with a view to ascertaining whether they contained men who showed signs of scurvy or could be considered as already "on the scurvy line." These observations, reported on in November last, were systematically made on ten representative groups, 300 men altogether, as they arrived on the transports. None of the men coming fresh from India showed signs of scurvy to any appreciable extent. As is usual with Indian troops, however, several were affected by pyorrhœa which produces a condition of gums and teeth which makes mastication disagreeable and leads to men avoiding meat and other food which has to be chewed. This is probably often an important predisposing factor to scurvy.

54. Although there is little evidence, from this inquiry, that the sepoy newly arriving in Mesopotamia has been accustomed to a diet so insufficient or badly chosen that he is always on the verge of scurvy—an assertion frequently made—there can be no doubt that he will be the better as a soldier, and better able to support the periods of diet deficiency which he may have to meet during the campaign, if he has previously been well fed and nourished. From this point of view the decision to supply Indian soldiers in India with a free ration represents a great advance. Effect has already been given to this decision since January 1st as a money allowance for food has been given. A

ration scale for troops in India is also being considered, and in view of our experience in Mesopotamia we have submitted some notes to the Director, Medical Services, India, on the subject.

The free ration allowance in India does not at present extend to followers. As it may happen that followers are some little time at camps in India and on transports before reaching Basrah, it is important to see that their diet during this period contains anti-scorbutic constituents such as meat or milk, or at least potatoes or green vegetables. The arrangements at the new camps at Bombay where the porter and labour corps are collected, though otherwise excellent, seemed to us deficient in regard to dietary : we understand that, at the instance of the Director, Medical Services, an alteration of the diet arrangements is now being considered.

55. Lieutenant-Colonel Marjoribanks drew attention to the fact that the reinforcements examined by him included men previously invalided to India on account of scurvy and still showing signs of scurvy on their return to Mesopotamia. Such men are almost certain to break down, and it would be well to ascertain whether any subsequent arrangements made to prevent their premature return have been effective.

56. On analysis of information obtained for us by medical officers of Indian hospitals at Sheikh Saad (178 cases in October) and at Amara (192 cases in November) it appears that about 7 per cent. and 8 per cent. respectively of these cases had been in Mesopotamia less than 3 months before reporting sick with scurvy. The majority of cases had been over 6 months in Mesopotamia before being sent to hospital with this disease.

57. The Director, Medical Services, informed us that steps were being taken to give effect to the suggestion in paragraph 73 of our report on the 3rd I. A. C. that a special medical observation should be made of selected new drafts to determine the effect of the present ration in regard to scurvy. It would be well for such observations to be continued in the hot weather, and to circulate freely any practical conclusions which result from the work.

58. Generally speaking, the outlook as regards scurvy in the present year is hopeful. As indicated in the report on the 3rd I. A. C., prevention of scurvy seems to lie mainly (*a*) in securing that the Indian dietary includes as much as possible of available anti-scorbutic foods, in particular meat, potatoes, onions, green vegetables and fresh limejuice, and (*b*) in organisation and unit discipline which secures that such constituents are properly distributed to and consumed by the soldier or follower.

In view of our experience of the conditions associated with scurvy in the 3rd I. A. C. we have in all subsequent local inspections conferred with supply, medical and combatant officers on the various details which must receive attention for both the above purposes, and were satisfied that the progress made has been very great, though difficulties in getting perishable supplies to the more advanced area will no doubt recur in the hot months. It includes comprehensive arrangements for obtaining locally grown vegetables at Amara and better means of getting those articles rapidly up river; the establishment of gardens at Sheikh Saad ; also the provision of good fresh limejuice made in Bombay and improved packing of potatoes in India, both of which can continue to be sent for some two months longer. Large supplies of onions are being sent from India. A more regular supply of wood has been obtained for cooking, a scarcity of which has been one of the main difficulties. Following work by Dr. Chick at the Lister Institute it is now suggested that a trial be made of the anti scorbutic properties of dried whole peas which have been steeped in water and begun to germinate.

59. We have directed special attention to the inadequacy of the supplies sometimes given at detached posts and to small bodies of men on boat escort or like duties or returning to duty from convalescent depôts. In such cases the system of issuing cooking utensils for Indian troops in sets (*e.g.*, for platoons) may not be applicable and men may be for some time without proper cooking utensils. The Deputy Director of Ordnance, Basrah, is arranging for a reserve supply of cooking utensils and when these are available arrangements should be made for them to be held at suitable points for issue on occasions of this kind.

Polyneuritis.

(*Beri-beri.*)

60. In 1915, it is stated, Indian troops in Mesopotamia suffered from scurvy and British troops from beri-beri, each being associated with special conditions of diet deficiency. In 1916, however, practically no beri-beri occurred during the summer or autumn months amongst British troops although it was in that period that any shortage of food or absence of variety in diet were most apparent. A few British scurvy cases were reported but the number was inconsiderable. In the whole force, only 8 cases of beri-beri or supposed beri-beri were reported in September and 12 cases in October. In November and December some 70 to 80 cases were heard of, the bulk of which (upwards of 65) occurred in a single regiment, the 1-4th Somerset Light Infantry while in camp at Shaiba about 10 miles from Basrah. This regiment has been at the base since July. We conferred on this matter with various officers concerned on December 17th, and have since seen reports on the subject by Captain Stevenson, I.M.S., of the Central Laboratory, Basrah, who has made a careful epidemiological study of the Shaiba outbreak and is inquiring into any other cases of beri-beri reported at the base. We have also seen a memorandum by the Consulting Physicians (December 24th) on the question. Further facts as to the subsequent cases not arising at Shaiba must be awaited, but meanwhile it is noteworthy that there is very little evidence that the Shaiba outbreak can be attributed to any greater deficiency in food containing "vitamines" than has existed in any other British force at the base. As a whole, the diet of the regiment and of the men affected appears to have been sufficient in quantity and varied, and whatever may have been its exact vitamine constituents they are hardly likely to have been so strikingly deficient that beri-beri could result from the diet in 3 or 4 weeks. There seems to be clear evidence, in several cases where the matter could be tested in the case of new drafts, that the time required for development of the disease at Shaiba was no longer than this, certainly under seven weeks. Apparently ordinary chronic metallic poisoning (including lead, arsenic and manganese), can be definitely excluded. Suspicion however still rests on the drinking and cooking water of the 1-4th Somersets at Shaiba, which is obtained from a local well, the water of which contained 368 parts of total solids per 100,000 (258 grs. per gallon) consisting mainly of sulphates of calcium, sodium and magnesium, as having been in some way or other concerned with the outbreak. Tigris water has since December 28th been taken to the camp for cooking purposes. Alternatively the possible operation of a toxin, produced by bacterial infection, has to be considered. The fact that a considerable proportion of those attacked had previously suffered from malaria is also noteworthy. Observation on these and other points will be maintained as far as possible by Captain Stevenson. Even if no complete explanation emerges, it is very important, as a guide to preventive measures, that all possible information, both positive and negative, should be obtained as to the circumstances in which this puzzling form of polyneuritis occurs.

Heat Stroke.

61. In view of the fact that many of the medical officers in Mesopotamia are naturally unfamiliar with the symptoms and treatment of heat stroke, the Committee has asked that the section in the "Memoranda on Medical Diseases in the Mediterranean War Area" dealing with this condition be issued as a separate pamphlet for distribution in Mesopotamia.

62. It is satisfactory to note that the Officer Commanding, River Sick Convoys, has taken measures to ensure that there will be adequate protection from the sun on board all steamers and barges conveying sick and wounded. Arrangements have also been made to obviate as far as possible in other directions the ill effects due to excessive heat during the river journey. In some places, however, there is need for *chatai* or other suitable shelters on the river bank for the reception of sick awaiting embarkation on the steamers.

63. A matter of great importance is the provision of a sufficient supply of drinking water during the hot weather. In many cases the quantity arranged for is 3 gallons per head per man daily. Under ordinary conditions, this, if not a liberal, is at least an adequate quantity, but under the conditions obtaining during the summer in Mesopotamia, the physiological needs of the body may demand a larger quantity of fluid. The amount supplied must, of course, be determined by local conditions. The Committee merely wish to advance a plea against any tendency to stereotype the quantity of drinking water supplied to the troops. It should be as ample as circumstances permit and should be increased when necessary to meet the loss of fluid incurred during heavy physical exercise.

Part III.—MISCELLANEOUS OUTSTANDING POINTS.

Food Supplies and Rations.

64. As a whole the food supply of the troops and followers at the date of our leaving Mesopotamia was abundant and rations good. We have referred above under the heading "Scurvy" to some of the developments which have taken place, to which may be added a comprehensive system for the supply of frozen meat for British units and various measures to maintain the meat ration for Indians. Oil-cooking stoves are being introduced. Particular points coming under notice during our inspections are noted in the index below. The proposed arrangement largely to substitute ordinary sugar for *gur* as an Indian issue has several advantages, especially if it is impossible to pack the *gur* in tins. It is well that articles like flour and *atta* should reach the troops as speedily as possible after the grain has been milled, as otherwise much trouble from insect, mould, etc., may arise. This point may usefully be kept in mind in arranging the period for which reserve stocks are held.

Preparation of food and its protection from contamination.

65. The best possible arrangements for the selection and supply of rations may of course fail if cooking is bad or needlessly monotonous, and good feeding is undoubtedly one of most important of all measures for maintaining physical fitness and increasing resistance to disease, especially under the trying conditions met with in Mesopotamia. We have urged in several reports that, from this point of view, travelling kitchens would be of the greatest value to British troops, and we were glad to learn on leaving Basrah that a supply of these kitchens had arrived and was ready for issue to British units. Arrangements were also being considered at the base for courses of instruction in cooking, to which men could be sent from any part of the force. It is desirable that these should be got in hand at once on a sufficiently large and practical scale, and undertaken by a thoroughly competent teacher giving his whole time to the duty and having all necessary assistants and material.

The sanitary demonstration area at Basrah should contain good examples of simple improvised cook-houses and cooking areas, completed and ready for use. Suggestions to this effect have been made to the Officer Commanding, 46th Sanitary Section, and we append (Appendix No. V) a note, adapted from our reports in Salonica, on the points which should receive attention at all cook-houses and cooking areas, however makeshift. Cooks seldom keep basins, soap or towels at the cook-house: the provision of these articles, and their systematic use when provided, should receive the attention of every unit medical officer: the matter, with other details of cleanliness in the preparation and handling of food, cannot be too strongly pressed for the prevention of dysentery and other diseases which are similarly spread. We hope that in all British camps, except the most temporary, efforts will be made to provide messing huts, shelters or dugouts, with good arrangements adjoining them for thoroughly cleansing all food utensils after meals, in place of the present practice of messing in the men's sleeping huts or tents.

66. We make no suggestions as to cooking places for Indian troops. We note, however, a suggestion that the tentage allowance of Indian regiments in the field should be increased so as to supply canvas shelters for company cooking: This suggestion, which was made by a Commanding Officer who had given close attention to the cooking for his men, seems a good one.

We have already referred (paragraph 59) to the provision of supplementary individual cooking sets for Indians in certain circumstances. This is important not only in regard to scurvy but to bowel complaints. Insufficiently cooked *dhal*, *chapatties* and other food may act as irritants and frequently determine attacks of colitis or diarrhœa and relapses of dysentery.

67. Men recently convalescent from enterica or dysentery should not be employed as cooks or in the distribution of food by hand. The Medical Officer of the unit should frequently inquire specially as to the health of all men so employed with a view to detection of the existence of infectious bowel complaints.

Chemical treatment of Water-supplies.

68. The general routine now established consists in the addition of bleaching powder to the water, usually after settlement with or without alum, in amount calculated to add 0·8 part of free chlorine per million, the resting period before the water is used being at least half an hour. The bleaching powder is issued as a strong solution, obtained by thoroughly mixing it with water in a hand churn, and its strength is fully tested before issue. Captain Morison, I.M.S., by whom this work has been systematised, is also arranging in the case of certain local piped supplies, for an automatic chlorination on the intake pipe. It is found that the turbid water of the Mesopotamian rivers loses over 90 per cent. of its suspended matter by 24 hours' settlement, and where sufficient natural settling can be secured, routine addition of alum can be dispensed with, or the amount of alum greatly reduced. This point, which is being studied at the Central Laboratory, is of special importance in connection with the working of the mechanical filters which are now arriving. These provide in addition for water chlorination on a large scale. It is understood that the large water sterilizing barges, being sent from home, should reach Basrah shortly.

Disinfection.

69. Some railway disinfecting vans for use in Mesopotamia (see Euphrates report, paragraph 19) are now to be fitted out in India. These, if speedily completed and despatched, should be of great service. They should be sent out with spare locomotives of obsolete type. The principle of disinfecting clothing on a large scale by improvising a chamber into which current steam is delivered deserves wider recognition in Mesopotamia than it has hitherto received. As an additional means of getting rid of lice, more use might be made of emulsions of soap and kerosine, both for body cleansing and washing clothing. A method of making a satisfactory emulsion has lately been worked out at the Central Laboratory, Basrah, and this should facilitate the issue of the emulsion on a large scale.

Laboratory Stores and Material.

70. The shortage of apparatus, stains, media-making material and other articles required by the bacteriologists is badly hampering the development of necessary laboratory work in Mesopotamia. Some notes illustrating this shortage and the nature of the more pressing requirements will be found in Appendix III below. Many articles have to be obtained from England, and under present conditions of transport serious delay is doubtless unavoidable. Much, however, is obtained, or could be obtained, from India, and it is noteworthy that the R. A. M. C. medical store unit lately sent out from home to Bombay for the purpose of supplying Mesopotamia has to rely on the Bombay Indian base medical store depôt for the bulk of its supplies.

If these difficulties are to be met in the best way that circumstances allow it is important (*a*) that requisitions or bulk indents on the Bombay Depôt should be framed by a bacteriologist with direct information of the immediate and prospective needs of the several Mesopotamian laboratories, who is able to deal with the relative urgency of demands, and to secure that laboratory material which arrives at Basrah is distributed satisfactorily and economically to the laboratories where it is most needed, (*b*) that accurate information should be collected as to the supplies obtainable in India and the ways in which they may be procured.

The first of these objects would be fulfilled by the appointment of a consulting bacteriologist in Mesopotamia as recommended above in paragraph 18; one of his most important duties would be to deal with questions of laboratory equipment. The second seems to require the services of a bacteriologist in India, preferably at Bombay, to advise the R. A. M. C. medical store depôt as to the stocks which can be obtained in India and those which must be got out from England or elsewhere. If this officer were in direct communication with the consulting bacteriologist at Basrah, and when necessary visited Mesopotamia, the whole procedure would be greatly simplified.

Sanitary War Diaries.

Lieutenant-Colonel Fremantle R.A.M.C., (T), to whom we are indebted for several helpful suggestions, has urged that administrative sanitary officers, like officers in command of hospital units, should be required to keep war diaries for purposes of reference and record. We think that such diaries would be of practical use, particularly if effect is given to the administrative proposals outlined in Part I.

Telegraphic Summary.

The following is an epitome of the present report for use in telegraphic summary.

72. Medical Advisory Committee submit final report on outstanding matters Mesopotamia. Urge greater development preventive medical work by (1) appointment of a Deputy Director of Medical Services (Sanitary) for whole force with office at base aided by small Staff senior inspecting officers and consulting bacteriologist, (2) strengthening administration for sanitation of units, (3) attention to sanitary organisation Basrah. Good individual service in preventive medical work both in field and laboratory should be better recognised in matters of pay and promotion. Medical officers sent from home should be in a position to stay out at least a year and should be encouraged to bring microscopes and useful books; special effort should be made to get men with tropical experience.

Diseases.—Cholera. Advise general re-inoculation before end April with vaccine containing twelve th usand millions in double dose prepared Kasauli and previously tried India. Enterica. Advise general re-inoculation in autumn with vaccine containing in double dose fifteen hundred million each Para-A and Typhoid and seven hundred and fifty Para-B, to be prepared Kasauli and tried India. Stay of convalescents Indian enterica depôts should be ordinarily limited to 5 weeks. Carrier examinations there need not exceed 7. Dysentery. Do not advise campaign against amoebic and flagellate carriers amongst dysentery convalescents. Malaria. Major Christophers scheme systematic anti-malarial measures Basrah should be started at once. Necessary additional officers are being sent. Scurvy. Prospect this year much more favourable. Results of special inquiries as to different diseases reported.

More attention still needed cook-houses, cooking and risks of infection from food. Detailed suggestions made. Chemical treament water-supplies systematised and filtration plants arriving. Economical and efficient ordering and distribution of laboratory stores should be arranged by consulting bacteriologist in correspondence with bacteriologist advising Medical Stores, Bombay.

Committee returning to Egypt.

ACKNOWLEDGMENTS.

73. In concluding their reports the Committee would express their grateful thanks to Lieutenant-General Sir F. S. Maude, K.C.B., C.M.G., D.S.O., the Army Commander, for the facilities he afforded them in the prosecution of their work. Their thanks are also due to Surgeon-General F. H. Treherne, C.B., Director of Medical Services, for much kind assistance and they would again acknowledge their indebtedness to Colonel M. Fell, Deputy Director of Medical Services, Lines of Communication, for help and advice freely forthcoming at all times. To numerous other officers in Mesopotamia and India, both combatant and non-combatant, many of them already mentioned in the reports, they owe a great deal in the way of information furnished and arrangements made for their journeys and inspections.

At Bombay, the Assistant Director of Medical Services, Colonel Beyts, R. A. M. C., and his Staff were most helpful in various directions and the Committee wish especially to record their obligations to Captain MacIlwaine, C.I.E., R.A.M.C., and Captain Strachan, R.A.M.C., as also to Major Glen Liston, C.I.E., I.M.S., of the Parel Laboratory. During their stay in Delhi the Committee have received every assistance from Surgeon-General T. J. O'Donnell, C.B., D.S.O., Director of Medical Services, India, and his Staff. The same is true as regards Sir C. Pardey Lukis, K.C.S.I., Director-General, Indian Medical Service, who, with Major Norman White, I.M.S., also did everything possible to aid and expedite their work.

The Committee desire to record the good services rendered them by Sergeant E. Weavis, R.A.M.C., who has been attached to them for clerical work which he has carried out in a most conscientious manner.

We have the honour to be,

SIR,

Your obedient Servants,

ANDREW BALFOUR, LIEUT.-COL., R.A.M.C.

G. S. BUCHANAN, LIEUT.-COL., R.A.M.C.

J. C. G. LEDINGHAM, LIEUT.-COL., R.A.M.C.

C. M. WENYON, LIEUT.-COL., R.A.M.C.

DELHI:
13th March 1917.

Appendix I.

TELEGRAPHIC SUMMARIES SENT WITH PREVIOUS REPORTS.

1.—Basrah Base Area—September 1916.

General.—Conditions have obviously greatly improved, and difficulties being actively met. *Sickness.*—Rates high, producing serious interference with daily work. Improving with advent of colder weather; causes varied; largest figures those for diarrhœa and dysentery group; malaria; and effects of heat. Since mid-August effects of heat fallen but sandfly fever greatly increased. Enterica, chiefly paratyphoid A, and cholera showed sustained prevalence up to middle September. Practically no scurvy originating at base.

Area essentially unsuitable to healthy occupation by troops and requires perpetual attention to great variety of details if disease is to be reduced.

Sanitary organization.—Requires strengthening. Measures needed include:—Three sanitary sections for specified areas.

Addition of trained British Sanitary Section from Egypt.

Whole-time port sanitary officer, with launch.

Definite allotment of responsibility between military and civil sanitary services.

Disciplinary action where needed in support of sanitary requirements.

Water supplies.—Local piped Shatt-el-Arab supplies should be immediately completed, but considered as makeshifts only.

Special officer for supervision of all local chlorination is suggested.

Public water supply from source other than Shatt-el-Arab needed; experimental deep borings should be pressed.

General Sanitary requirements.—Suggestions made in detail on various practical points, with a view to circulation of the report to all officers concerned.

Disinfection.—Proposed new central station urgently required; also repairs to floating Clayton apparatus.

Hospitals.—Generally good, supplies adequate.

Isolation Hospital.—Retention on present site advised, provided specified important improvements, including pier, are undertaken.

Special Diseases.—Malaria; no new cases expected mid October to March. Better organisation of quinine prophylaxis should be considered before April and mosquito nets below 18 holes to linear inch discarded. Dysentery, special series of laboratory investigations started; recommendations made for more effective use of emetin and serum and avoidance of waste. Enterica; now possible to press T. A. B. inoculation in British Units. Scurvy; preliminary inquiries made at the base but observations deferred. For all sick the available case notes should accompany the patient on transfer to new hospital or hospital ship.

Bacteriological Requirements.—Additional laboratory needed for Indian hospitals and a new scheme for regulating laboratory supplies. Peptone and agglutinating sera urgently required, other stocks need replenishing.

2.—Sheikh Saad—October 1916.

No telegraphic summary sent.

3.—3rd Indian Army Corps—October 1916.

Medical Advisory Committee submitted full report on inspection 3rd Indian Army Corps. All the Divisions visited. Summary of report as follows:—

1. *General Sanitation*—Arrangements and administration leave little to be desired. Work Assistant Director, Medical Services, and Sanitary Officers efficient. Supervision and co-ordination of Divisional Sanitation and disease prevention by Corps Deputy Director, Medical Services (Sanitary), has been invaluable. To dislocate this work as result of rearrangement forces at front would be disastrous. Committee has represented various details locally and in report No summary of them necessary. Following are urgently needed:—

Iron water pipes, hose pipes, tarpaulins for water supplies. Canvas repairers, assorted rubber corks and spare parts for nascent chlorine apparatus. Cresol, chlorinated lime and oil for disinfection. Sufficient issue lamp oil for battalions. Corrugated iron, wood, canvas and sacking for cookhouses, bake-houses, latrines, and wash-houses, field cookers for British regiments and Field Ambulances, wire gauze for flies. Iron bars for incinerators. Serge clothing. Stoves for Field Ambulances. More transport for (divisional) Sanitary Sections (Indian).

Remedy deficiencies sweeper personnel.

For next summer ice and soda water plants and hot air fans essential.

Fly experts should be commissioned officers.

Vermijelli advised as sandfly repellent.

2. *Disease.*—Report reviews causes heavy sickness in corps during 1916. Divisions now recovering from effects of past epidemics, heat and deficiencies in diet. Have actively eliminated sick and are receiving healthy drafts. Much greater health and energy resulting cooler weather and good sanitary work. Food received by British troops satisfactory. New British winter ration scale generous. Practically no British scurvy or beri-beri.

Corps experience is all against sending men direct from England to Mesopotamia in hot weather.

Now little epidemic disease except Indian scurvy. Diarrhoea, dysentery and enterica low. From July to October over 7,500 cases scurvy in Corps. Majority undoubted scurvy, many severe. Results serious as all definite scurvy cases require evacuation to India. Incidence general throughout force, heaviest on division where greatest deficiencies food supplies and transport. Epidemic resulted primarily from continued diet very deficient in fresh meat and vegetables. Fuel often short. Other auxiliary causes indicated. Self-induced scurvy only a minor factor.

Active steps taken recently to detect early scurvy and improve diagnosis. Results satisfactory. Elimination early scurvy cases largely responsible recent high figures. Sharp fall set in and present position encouraging. Meat received Indian troops increased generally to 6 oz. daily during September and October and food supplies much more regular. Committee recommend series special observations on men recently joined to test effect new conditions of diet.

3. *New Indian winter ration scale.*—Allowance of meat and fresh vegetables at 6 oz. each should not be stereotyped but increased when supplies permit. Gur should not be given as substitute for meat but daily allowance ordinary sugar in addition to gur in great request and recommended. Tamarind allowance excessive. Preference of Indians for sweetened condensed milk should be met if possible. Questions of quality of ghi, limejuice, etc., noted for any necessary communication India. If genuine limejuice procurable, limejuice should be restored to Indian winter ration.

4. *Laboratories.*—Additional. British bacteriologist required laboratory barge—Laboratory at Sheikh Saad should be expedited.

4.—Lines of Communication—November 1916.

Medical Advisory Committee report on inspection November along Lines of Communication Sheikh Saad to Basrah, including 3 weeks at Amara. No conspicuous epidemics, prevalence generally of dysentery, chiefly bacillary, colitis, diarrhœa and enterica. No typhus or relapsing and few cases only cholera and plague which under control.

Committee's inspections thorough. Local questions dealt with at time of visit and memoranda left with Assistant Directors, Medical Services, thereon. As a whole preventive work active and rapid progress being made. Report includes following :—

(1) *Local.*—Amara. Speedy completion Tigris front piped water-supply and sanitary tramway for winter important. Undesirable at present stage to place sanitation in hands of municipal councils. Vigilant sanitary inspection of camps and surroundings being organised and must be maintained. Hospitals excellent. Advise obtaining from India a visiting physician for Amara hospitals with authority and experience tropical disease. Kurna should be avoided as far as possible as station for troops after March. Special anti-malaria measures indicated there also at marching posts—Latter have been in bad sanitary condition but now being dealt with systematically.

(2) *General.*—Officer Commanding, Central Laboratory, Amara, should co-ordinate work at all laboratories in and above Amara. Notes sent with patients often useless or absent. System requires better supervision. Memoranda prepared on laboratory examinations dysentery and enterica and on precautions necessary against hospital infection. Both now circulated to hospitals. Widal tests should be abandoned in T. A. B. inoculated cases. Malaria relapses common. Arrangements needed for continuance of quinine after convalescence. Comparatively little scurvy occurring Lines of Communication but greater attention should be given to dietary of Indians by Officers of Indian units including meat and vegetables in rations drawn. Food supply generally satisfactory. Attention needed to rations at smaller posts. Adulterated *ghi* frequently reported. Advise issue rum on authority S. M. O. Sweepers up to establishment and good reserve in India being obtained. Additional local establishment of sweepers can be arranged for special places. Flies diminishing, special camp inspections regarding fly breeding places should be organised early spring.

Committee returned Basrah proceeding Nasiriyah thence Ahwaz.

5.—Euphrates and Karun, December 20th 1916—January 20th, 1917.

Medical Advisory Committee report on inspection of forces on Euphrates and Karun. Health of both forces has been good though prevalence and prevention of enterica infections need attention. Jaundice prevalent but type mild. Some smallpox at Ahwaz. Hospitals satisfactory as also convalescent depôts at Muhammerah. Report deals with various details of sanitary improvement requiring or receiving attention, General points raised are similar to those of Committee's Lines of Communication Report,—November. Vaccine lymph often unsatisfactory, its despatch from India and distribution need attention. More microscopes required. Railway steam disinfecting vans as in Egypt should be provided. Simple method of using oil fuel for Indian cooking being tried at Ahwaz and promises important results. Systematic recuperative leave to men after certain period of service in Mesopotamia most advisable on medical grounds. Committee's inspections concluded—returning Egypt *viâ* India.

A concluding report on outstanding matters affecting Mesopotamia to be sent from India.

Appendix II.

TABLES AS TO WEEKLY SICKNESS 1916, AND TEMPERATURE RECORDS AT BASRAH.

Table 1.—Whole Mesopotamia Force. Admissions of sick, percentage for each week of 1916.

Week ending :—

January 8th .	1·49	April 1st .	2·07	July 1st .	5·77	October 7th .	2·4
„ 15th .	1 15	„ 8th .	2·10	„ 8th .	4·85	„ 14th .	2·4
„ 22nd .	1·24	„ 15th .	1·81	„ 15th .	4·86	„ 21st .	2·3
„ 29th .	2·07	„ 22nd .	2·27	„ 22nd	3·95	„ 28th .	2·0
February 5th .	2·49	„ 29th .	3·06	„ 29th .	3·96	November 4th	1·9
„ 12th .	1·90	May 6th .	3 75	August 5th .	2·8	„ 11th	2·0
„ 19th .	2·39	„ 13th .	4 10	„ 12th .	3·2	„ 18th	2·1
„ 26th .	2·16	„ 20th .	3·71	„ 19th .	3·3	„ 25th	1·9
March 4th .	1·69	„ 27th .	4 07	„ 26th .	3·8	December 2nd	2·3
„ 11th .	2·05	June 3rd .	4·17	September 2nd .	3·3	„ 9th	1 9
„ 18th .	1·80	„ 10th .	4·68	„ 9th .	3·7	„ 16th	1·9
„ 25th .	2·02	„ 17th .	4·63	„ 16th .	3·6	„ 23rd	1·8
		„ 24th .	5·60	„ 23rd .	3·0	„ 30th	1·5
				„ 30th	2·8		

Table 2.—Admissions of sick (to Field ambulances or direct to hospitals). Weekly percentages from July to December 1916 for British and Indian Troops and Followers.

Week ended.	Total Admissions.			Admissions at Base only.	
	Officers & all other ranks British.	Officers & all other ranks Indian.	Followers.	Officers & all other ranks British.	Total Indian.
July 8th	6·3	3·9	4·6	...	...
„ 15th	6·3	3·9	4·6	...	...
„ 22nd	6·0	3·0	2 8	...	...
„ 29th	4·5	3·0	3·6	...	...
August 5th	3·4	2·7	2·4	...	...
„ 12th	3·5	2·9	3·3	...	...
„ 19th	4·0	3·0	3·1	...	...
„ 26th	4·1	3·9	3·4	...	...
September 2nd . . .	3·7	3·0	3·1	...	...
„ 9th . . .	4·2	3·8	2·9	...	...
„ 16th	3·6	3·9	3·4	...	...
„ 23rd . . .	3·3	2·9	2·9	...	...
„ 30th	3·5	2·3	2·8	...	...
October 7th . . .	2·9	2·0	2·6	5·0	3·3
„ 14th	2·7	1·9	2·8	4·7	4·0
„ 21st	2·4	2·0	2·6	3·6	3·5
„ 28th	2·2	1·8	2·2	3·3	2·9
November 4th . . .	2·2	1·9	1·9	3·6	2·8
„ 11th	2·5	1·9	1·9	2·7	2·5
„ 18th	2·5	2·0	1·8	3·4	2·5
„ 25th	2·3	1·9	1·9	3·0	2·4
December 2nd . . .	2·9	2·0	2·0	2·6	2·8
„ 9th	2·6	1·6	1.8	3·1	2·2
„ 16th	1·8	2·0	1·7	2·6	1·8
„ 23rd	2·0	1·7	1·6	?	?
„ 30th	1·8	1·5	1·5	?	?

Table 3.—Mesopotamia Force.—New cases reported weekly of certain diseases, per 1,000 of strength, August to December 1916.

(*a*) British (officers and all other ranks).

Week ended.		Enterica.	Dysentery.	Malaria.	"P. U. O."
August	5th	1·9	2·4	2·4	3·2
,,	12th	1·2	2·3	4·2	2·5
,,	19th	1·8	2·3	3·3	3·7
,,	26th	1·1	1·3	2 0	5·3
September	2nd	1·4	1·3	1·7	6·2
,,	9th	1·5	1·0	1·9	5·1
,,	16th	1·5	1·0	1·9	4·0
,,	23rd	1·5	1·4	2·0	2·2
,,	30th	1·4	1·0	1·7	1·6
October	7th	1·7	1·7	2·2	1·3
,,	14th	1·3	1·4	2·1	1·1
,,	21st	1·3	1·3	2·1	1·5
,,	28th	1·0	1·2	2·3	1·1
November	4th	1·0	1·3	2·1	1·0
,,	11th	1·1	1·2	2·1	1·8
,,	18th	1·4	1·4	2·0	1·2
,,	25th	0·9	2·0	1·7	0·9
December	2nd	0·5	1·9	2·4	0·9
,,	9th	0·3	2·0	2·0	1·3
,,	16th	0·2	1·1	1·9	0·8
,,	23rd	0·5	1·5	1·6	?
,,	30th	0·4	1·5	1·3	?

Table 4.—Mesopotamia Force. New cases reported weekly of certain diseases, per 1,000 of strength, August to December 1916.

(*b*) Indian (officers and all other ranks and followers).

Week ended.		Enterica.	Dysentery.	Malaria.	"P. U. O."	Scurvy
August	5th	0·2	1·8	5·7	3·1	4·5
,,	12th	0·2	1·6	3·9	1·7	10·0
,,	19th	0·2	1·8	3·8	1 2	8·1
,,	26th	0·3	1·3	4·3	1·8	9·2
September	2nd	0·1	1·1	4·3	1·7	6·4
,,	9th	0·04	1·2	4·0	1·7	7·6
,,	16th	0·15	1·2	3·9	1·3	7·0
,,	23rd	0·13	1·6	3·0	1·0	6·9
,,	30th	0·1	1 4	2·9	1·1	4·5
October	7th	0·16	1·4	2·3	1·2	3·9
,,	14th	0·11	1·6	2·9	0·9	3·0
,,	21st	0·19	1·6	2·5	1·1	2·6
,,	28th	0·05	1·4	2·4	0·9	1·4
November	4th	0·09	1·5	2·6	0·5	1·4
,,	11th	0·09	1·6	2·4	0·7	1·7
,,	18th	0·08	1·4	2·0	0·7	1·6
,,	25th	0·12	1·6	1·7	0·6	0·9
December	2nd	0·06	1·6	1·6	0·7	1·0
,,	9th	0·04	1·5	1·6	0·6	0·5
,,	16th	0·07	1·7	1·1	1·0	0·7
,,	23rd	0.1	1·4	1·0	?	0·4
,,	30th	0.03	1·6	0·9	?	0·6

Table 5.—Mesopotamia Force. New cases reported weekly of certain diseases (actual numbers, July—December 1916.

Week ended.	Cholera.*		Plague.		Cerebro-Spinal Fever.		Smallpox.		Beri-beri.	
	British.	Indian.	British.	Indian.	British.	Indian.	British.	Indian.	British.	Indian.
July 8th	71		...		...		...		...	
„ 15th	66		...		...		...		2	
„ 22nd	38		4		2		6		1	
„ 29th	30		...		...		1		...	
August 5th	8	31	...	7	1	...	...	...	1	1
„ 12th	7	58	...	3	...		...	...	...	...
„ 19th	12	73	...	...	...	1	...	...	...	...
„ 26th	21	38	...	...	...	...	...	...	...	...
September 2nd	65	25	...	...	...	...	...	...	...	2
„ 9th	17	33	...	...	...	...	...	...	3	...
„ 16th	11	29	...	...	...	1	...	...	...	1
„ 23rd	6	9	...	...	...	...	...	...	2	1
„ 30th	8	7	...	9	...	1	...	...	1	...
October 7th	8	33	...	6	...	2	..	...	2	...
„ 14th	3	29	...	10	1	1	...	...	5	...
„ 21st	4	38	...	10	1	1	...	...	6	...
„ 28th	4	15	...	7	1	1	...	...	1	...
November 4th	2	6	...	8	...	4	...	...	...	...
„ 11th	2	9	...	5	...	13	...	...	...	1
„ 18th	4	5	...	4	1	17	1	1	2	...
„ 25th	..	5	...	9	...	...	...	...	11	...
December 2nd	...	3	...	1	...	1	...	1	5	...
„ 9th	...	...	...	2	1	...	...	5	9	1
„ 16th	...	...	...	3	1	5	...	3	35	...
„ 23rd	...	...	...	2	...	...	...	9	12	...
„ 30th	...	...	...	1	...	...	...	6	6	1

* So far as can be ascertained, in 1916, about 1,100 cases of cholera occurred in the whole force up to the end of July, the bulk of which were reported in April and June.

Table 6.—Meteorological Station, No. 3. B. G. H., Basrah. Minimum and maximum temperatures recorded in each week (dry bulb).

Week ended.	Temp.		Week ended.	Temp.		Week ended.	Temp.	
	Min.	Max.		Min.	Max.		Min.	Max.
Jan 1			May 6	72·3	97·5	Sept. 2	71·2	105·3
„ 8	38·1	71·3	„ 13	72·1	101·1	„ 9	55·6	107·2
„ 15	41·1	70·3	„ 20	75·1	102·7	„ 16	45·4	109·1
„ 22	34·1	66·3	„ 27	72·7	104·5	„ 23	59·2	100·5
„ 29	34·6	59·8	June 3	74	104·8	„ 30	61	100·5
Feb. 5	31·1	62·3	„ 10	73·4	103·3	Oct. 7	57	95·1
„ 12	38·1	68·3	„ 17	75·2	107·6	„ 14	54·6	94·1
„ 19	45·1	71·3	„ 24	78·3	106·3	„ 21	56·6	97·1
„ 26	47·1	76·3	July 1	77·9	111·3	„ 28	48·6	89·5
March 4	44·1	74·3	„ 8	76·8	106.3	Nov. 4	49·4	93·5
„ 11	58·6	83·3	„ 15	77·3	108·1	„ 11	59·2	91·5
„ 18	51·6	83·8	„ 22	77·3	112·9	„ 18	54	90·1
„ 25	52·1	86·6	„ 29	78·8	109·9	„ 25	45	84·9
April 1	55·9	88·1	Aug. 5	76·8	104 3	Dec. 2	46·4	79·9
„ 8	54·6	88·1	„ 12	73·8	106·5	„ 9	48	80·5
„ 15	58·6	84·3	„ 19	71·8	105·1	„ 16	40·6	77·9
„ 22	60·6	89·1	„ 26	70·2	104 3	„ 23	39·4	72·5
„ 29	59·9	98·1	...	...	...	„ 30	45·6	75·9

Appendix III.

BACTERIOLOGICAL REQUIREMENTS.

1. *Consulting Bacteriologist* :—The following is an extract from a memorandum on Bacteriological facilities and requirements in the Basrah Area, which was forwarded to the Director, Medical Services, Mesopotamia, in September 1916.

"Arrangements for the supply of bacteriolgical requisites either from India or from England require to be placed on a sound footing. The necessity for ensuring a regular supply of current material for bacteriological laboratories and of obtaining expert advice as to the relative importance and urgency of requisitions has engaged our attention elsewhere. In the Eastern Mediterranean and Malta, the matter has now for a considerable time been placed on a satisfactory footing. In Egypt for example, bacteriological supplies are indented for in advance by the Officer Commanding the Base Medical Stores, acting under the advice of the Bacteriologist in charge of the Central Laboratory, Alexandria These supplies on arrival are taken over in bulk by the Central Laboratory and there suitably housed, to be distributed immediately, on requisition, by bacteriologists working anywhere in Egypt. For the Mesopotamian Area we are of opinion that a corresponding arrangement would be of much advantage. The efficiency of the bacteriological organisation would be greatly promoted by the appointment of a suitable Senior Officer as Consulting Bacteriologist who would perform such functions as the following :—He would visit the laboratories of the area periodically, ascertain their present and prospective wants and arrange for the regular supply of laboratory stores from England and where possible from India. These stores would be distributed to bacteriologists indenting directly on him and would be housed in suitable premises under his supervision with adequate clerical assistance for book-keeping, packing, etc.

This officer could also be a member of, or be closely associated with, the present Central staff of the force and would co-ordinate the work in the various laboratories of the area, collect and analyse bacteriological data and advise on all matters calling for bacteriological enquiry. Officers performing such functions as these have in other areas contributed greatly towards the efficiency of the bacteriological work in their respective spheres of operation."

2. *Laboratory Supplies*—The following points are here noted :—

(*a*) In an additional memorandum to the Director, Medical Services (September 1916) referred to in paragraph 58 of the Basrah Report, the Committee suggested that a cable should be sent to the War Office at once for certain urgently required articles such as Fairchild's peptone, diagnostic serum, etc, the stocks of which were almost exhausted.

(*b*) The Committee was informed in October that 5 Pathological Outfits had been telegraphed for from England, also that it was proposed to ask India for 24 single box Pathological Panniers of a standard pattern, containing equipments of a simpler sort. Proposals had also been made for the upkeep of supplies and for a system of indenting in advance. These indents would go through the hands of the Assistant Director, Medical Services (Sanitary), of the Force for scrutiny. Emergency indents would be complied with from the Central Laboratories at the Medical Stores if available.

With regard to supplies, in addition to those cabled for from England and the 5 complete outfits, large six-monthly indents and supplementary indents were drawn up and forwarded to the Bombay Depôt.

(*c*) In December Lieutenant-Colonel Ledingham was asked by telegram from the Assistant Director, Medical Services (Sanitary), of the Force again to enquire at the Medical Stores 'Basrah' into the question of bacteriological stores and the stocks there available. The result of that enquiry is contained in the appended memorandum of 8th December 1916.

It should be added that at the date of our leaving Mesopotamia neither the complete pathological outfits nor the large supply indents had arrived in Mesopotamia. In the memorandum suggested additions to these indents were made and particular reference drawn to the necessity for larger supplies of Petri dishes, syringes and glass-ware generally, also to the necessity for microtomes, etc., etc. For lack of Petri dishes, the bacteriological examination of excreta in enterica and dysentery cannot be carried out on a sufficiently large scale. (See Lines of Communication Report, Amara Laboratory.)

(*d*) Laboratory material for Mesopotamia which is not obtained by direct order from England is, by recent arrangement, drawn from No. 11 Base Depôt Medical Stores, Bombay. On arrival at Bombay at the end af January Lieutenant-Colonel Ledingham visited this depôt which had only lately come out from England and with a very limited amount of material. It was ascertained that the supply of pathological stores brought out with the equipment was a very meagre one and there was no arrangement for its periodical renewal. Suggestions were made to the Officer Commanding the depôt (Captain Stanley, R. A. M. C.) regarding the articles that are in urgent demand in the Mesopotamia Laboratories and should be cabled for. A telegram for the purpose was sent on 15th

February 1917, to the War Office. With regard to indents for medical stores generally from Mesopotamia it was ascertained that owing to the shortage of stocks at No. 1 Base Depôt, 75 per cent of these indents had to be complied with by obtaining the material from the Indian Base Medical Store at Byculla.

At Delhi, the Committee drew attention to the possibility of assisting Mesopotamia by the direct despatch of Petri dishes and other articles, and the Director, Medical Services in India took immediate steps to give effect to this suggestion.

DELHI :
The 24th February 1916

The following is the memorandum referred to :—

In response to your telegram I paid a second visit to the Medical Stores on 13th December. The small stock of requisites at present on hand was inspected and the large six-monthly indent and supplementary indents have been studied and are here commented upon.

Stock in hand—

(1) Diagnostic agglutinating sera (Kasauli) 20-50 vials of each.

(2) 2lb. Witte's peptone.

(3) Fair stock of lactose, mannite, cane-sugar, dulcite.

(4) 20lb. Xylol.

(5) A few bottles of absolute alcohol but a very large quantity (200 lbs.) of methylated alcohol (Burgoyne and Burbidges).

(6) A few bottles of cedar wood oil.

(7) One Thoma-Zeiss hæmocytometer, two objectives 1-12 in 5 boxes of Toisson tablets and a small stock of blood stains.

(8) Some bottles of slides in spirit.

(9) Fair stock of granular litmus.

Comment.—With regard to diagnostic sera it might be well to indent for a stock of Lister Institute brands in addition especially Para A. Shiga, Flexner-Y., Cholera, Malta and Para-Malta. British General Hospitals generally contain these in their pathological outfits and they might be useful for supplementary tests in connection with doubtful or inagglutinable strains. There are no Petri dishes or agar or bile salt. These articles might be expedited. They must come from England and it might be some time yet before the large indents are complied with. With regard to peptone, the small stock of Witte might be issued to fully equipped laboratories for sugar media only.

It may be noted that sugar-free peptones obtainable from home are Fairchild's (already indented for) and Allen and Hanbury's Bacteriological Brand. The Central Amara Laboratory contains only about 2 dozen Petri dishes and its stock of test tubes is very limited.

Six-monthly indents and supplementary Indents.—These indents have gone to the Bombay Depôt but in most cases they will have to be complied with from home. So far no goods in connection with these indents have turned up.

Comment on Indents.—I would suggest a larger supply of glacial acetic, pyrogallic acid, K O H, Na O H, gelatin and formalin. The latter is essential for preserving large pathological specimens and a good supply is necessary. It might be well to consider the advisability of ordering a stock of assorted specimen jars, as many valuable specimens are lost owing to lack of preserving facilities. In Alexandria the Central Laboratory preserves specimens for hospitals and this practice might be followed in Amara and Basra. A microtome for use in Amara is urgently required.

A large supply of cover slips should be ordered. To prevent wastage, the heads of Central Laboratories might issue instructions as to the best methods of cleaning and preserving used slips.

I have noted a great lack of of syringes for blood culture work both in hospitals and laboratories. Each hospital and laboratory should have at least two syringes for this purpose (5 c.c. and 10 c.c. either all glass or Records).

A much larger supply of Petri dishes (especially 4 inch diameter) should be ordered as a considerable amount of cultural work in connection with excreta will be required especially in enterica cases where the blood culture fails and Widal tests are not applicable (T. A. B. cases). At least 5 gross Durham's tubes should be ordered. These, when fixed in plasticine or in small wooden racks, are most useful for microscopic agglutination work. Each hospital should be provided with a Thoma Zeiss and a Haldane haemoglobinometer in addition to a simple urine-testing set. Some sets were noted in the Amara Stores. In the larger laboratories attached to hospitals with electric supply, a few Martin centrifuges would be useful to replace the hand machines.

For Wassermann work in venereal sections of hospit als a supply of antigen and haemolytic serum should be ordered. Small petrol or spirit bunsens w ould be useful to replace ordinary spirit lamps for bacteriological work.

A description of a readily made alcohol bunsen is to be found in the Journal, Royal Army Medical Corps, for September 1916.

The order for haematoxylin and Indian ink should read respectively "haematoxylin crystals" and Indian ink (refined for spirochaete work). For work in connection with the diagnosis of amoebic dysentery 6 eyepiece micrometers (to drop into eyepiece) and 6 stage micrometers should be ordered. A large supply of Erlenmeyer flasks is desirable also 1 c. c. and 10 c. c. graduated pipettes (preferably to blow out).

Certain units such as Convalescent Depôts with hospitals attached urgently require facilities for microscopical diagnosis (dysentery, malaria, etc), and I would suggest an indent for at least 6 complete Spencer Lens Co. microscopes with mechanical stages and eyepiece and stage micrometers.

Pathological outfits cabled from England.—The five outfits cabled for from England, apparently left London about 14th October and ought to arrive soon."

Dated 18th December 1916.

Appendix IV.

DYSENTERY IN MESOPOTAMIA.

Memorandum by the Committee to the Director, Medical Services, Mesopotamia (forwarded January 1917).

At the instance of the Medical Advisory Committee, an enquiry to ascertain the relative incidence of amœbic and bacillary dysentery was commenced at No. 3 British General Hospital, Basrah, in September 1916. The investigation was carried out under the superintendence of Captain Boney, R. A. M. C., the Officer Commanding the Laboratory, who was also responsible for the bacteriological work involved, while Lieutenant Boulenger undertook the protozoological work.

The following is a succinct summary of the results obtained during the period of enquiry September 11th, 1916, to December 14th, 1916.

Acute Dysentery.

The stools of 263 cases of acute dysentery were examined microscopically. All contained blood and pus. *Entamœba histolytica* was found in 70, *i.e.*, in 26·6 per cent. of the total. Of the remaining 193 stools, 175 were submitted to bacteriological investigation with the following results:—

No. containing *B. dysenteriae* (*Shiga*)	56
„ „ „ (*Flexner*)	34
„ „ both *Shiga* and (*Flexner*)	5
Total .	95

Thus 95 cases of the 175 cases submitted to bacteriological investigation, or 54·2 per cent were proved to be due to infection by *B. dysenteriae.*

Two cases of mixed amoebic and bacillary infection were noted, *viz.*, (1) *E. histolytica* and *B. Shiga,* and (2) *E. histolytica* and *B. Flexner.*

Plating experiments were carried out as a rule only in cases of *acute dysentery* which microscopical examination had shown to be negative as regards *E. histolytica.*

In addition however to the acute cases (263), microscopical examination was made of the stools of 490 other cases, mainly, convalescent dysentery patients, with a few cases of colitis and diarrhoea. Of these 490 cases, the stools of which did not contain blood or mucus, 48 or 9·7 per cent. were found to contain *E. histolytica* either in the vegetative or encysted condition.

It is apparent from these results as a whole that Bacillary Dysentery is the predominant type in the Mesopotamia area (as in other war areas) and there is little doubt that had the cases investigated been in the main local admissions instead of transfers from up river, the proportion of bacteriologically proved bacillary cases would have been still higher.

BASRAH;
January 1917.

Appendix V.

Memorandum on the prophylactic inoculations with T. A. B. and Cholera vaccines for use in Mesopotamia. (Forwarded to Director, Medical Services, India, and Director-General, Indian Medical Service, February 1917.)

Two of our members (Lieutenant-Colonel Balfour and Lieutenant-Colonel Ledingham) have returned from a brief visit of inspection paid to the Central Research Institute, Kasauli. The opportunity of visiting this Institute was warmly welcomed by the Committee as they were particularly desirous to discuss with the scientific staff who prepare the T. A. B. and Cholera vaccines for the troops in Mesopotamia, certain questions connected with prophylactic inoculations arising out of their experiences in the Mesopotamian area. Major F. Norman White, C.I.E., I.M.S., accompanied Colonel Balfour and Colonel Ledingham on this visit and to him, and Majors Brown and Cunningham of the Central Research Institute and to Major McKendrick of the Pasteur Institute we are greatly indebted for the excellent arrangements made to facilitate our inspection. We were shown the various steps in the preparation of the prophylactic vaccines from the start to the finished product and were greatly impressed by the care taken to ensure the purity of the various constituents of these vaccines at every step in the process, their accurate standardisation, and their final incorporation as a carefully tested sterile product in sealed glass vials. The general arrangement of the laboratories and equipment left nothing to be desired.

With regard to the preparation of the T. A. B. vaccine in the first instance, it was explained to us that the strains of T. A. and B. used, are those supplied to the Central Research Institute in May 1916 by the R. A. M. College, Millbank. All three strains are grown on agar. Sterilisation is effected by heating at 56° C. for half an hour followed by the usual carbolization. We discussed the propriety of employing a lower temperature for the initial heating and it was finally arranged to adopt in future the Millbank formula which prescribes a temperature of 53° C. for a somewhat longer period. The important question of dosage was then discussed. The T. A. B. vaccine prepared at Kasauli for the troops in Mesopotamia (and also for use in India) is exactly half the strength of the R. A. M. C., vaccine prepared at Millbank. Thus the first dose of the Kasauli product contains 250 million T., 187 million A. and 187 million B., giving a total of 625 million organisms in a volume of 0·5 c. c. while the Millbank product contains in its first dose 500 million T., 375 million A. and 375 million B. giving a total of 1,250 million organisms in 0·5 c. c. The second doses in each case are exactly double the first. In adopting the half strength dosage of the T. A. B. vaccine the scientific staff at Kasauli were influenced by previous experience in connection with the inoculation of native troops in India against Enteric Fever, the dosage of *B. typhosus* having been just half that of the old typhoid vaccine prepared at Millbank. It was felt that the employment of higher doses might militate strongly against the practicability of systematic immunisation of Indian troops, under a voluntary basis, in view of the possibly severer local and general reactions to which an increased dosage, similar to that of the R. A. M. C. vaccine, might give rise. Nevertheless, with the half-strength dosage employed, complaints (sometimes couched in extravagant language) not infrequently came from Mesopotamia during the hot season of 1916, in which excessively severe reactions following this vaccine were alleged. It must be said at once that experience has taught that systematic inoculation of troops both British and Indian with the T. A. B. vaccine must be carried out with the greatest caution during the hot season if trouble from severity of reaction is to be avoided. We are of opinion, indeed, that during the hot season in Mesopotamia such inoculations should be held in abeyance and arrangements made for systematic inoculation in the colder seasons. On this point we propose making certain representations elsewhere but the above consideration must always be borne in mind in appraising and interpreting the data regarding excessive local and general reactions collated during the hot season. After the resumption of systematic inoculation from August 1916 onwards, complaints with regard to excessive toxicity of the vaccine sent to Mesopotamia, have not been forthcoming.

These points were discussed at our conference and the question then arose whether the dosage of the Kasauli vaccine might not be raised to the strength of the Millbank vaccine, provided arrangements were made for systematic inoculation during the cold season.

With regard to the typhoid element in the triple vaccine it was represented that British troops serving in Mesopotamia should receive the same protection against enteric fever as their fellows in France and the Mediterranean. In so far, therefore, as the dose of *B. typhosus* in the triple vaccine may be held to contribute to this protection, it appeared reasonable to consider the question of doubling the typhoid element in the vaccine and thus bringing it up to the Millbank strength in this particular.

With regard to the A and B elements in the Kasauli triple vaccine, our Committee laid stress on the great preponderance of Para-A. infections in the Mesopotamian area and also on the undoubted fact that a considerable number of bacteriologically verified Para-A. cases have occurred after complete inoculation with the triple vaccine. As we have said, the A. element in the Kasauli vaccine is, like the other elements, half the strength of the A. element in the Millbank vaccine. Para-B. infections, on the other hand, have been relatively few, though the possibility of their increase during the coming enterica

season has to be borne in mind. It would appear, for instance, that in Egypt the proportion of Para-B. infection has in recent months been on the up-grade.

The whole question was very fully considered and it was provisionally agreed that official sanction should be sought for a trial test at the earliest possible moment on a series of hitherto uninoculated British and Indian troops in India (*e.g.*, 100 men in each series) with a triple vaccine containing in its first dose 500 millions of T, 500 millions of A. and 250 millions of B. This dose, it will be observed, contains the same total number of organisms as the corresponding Millbank dose, but the A. element is increased at the expense of the. B element in the Millbank formula. Major Brown, I.M.S., was desirous to conduct this test personally and suggested that sanction might be asked for such a trial to take place at a depôt somewhere in the neighbourhood of Kasauli such as Lahore. Should sanction for this be obtained, the test should be carried out as soon as possible so that the hot weather factor in enhancing the reaction of the vaccine may be as far as possible eliminated. Pending the result of this test, the preparation of the vaccine according to the old formula should be proceeded with. At the trial comparative tests might also be made with the ordinary Millbank formula so that the influence of the increased amount of A. in the suggested new formula may be adequately evaluated.

Cholera vaccine.—This vaccine is prepared at Kasauli from three cholera strains—one, a stock standard strain, the other two, fresh strains periodically added from recent cases of Indian cholera. The brews are separately grown and it was recommended that in future the vaccine should be prepared from three separately grown and finally mixed cholera strains, one being the stock standard strain and the other two representing recently isolated Mesopotamian strains. The dosage of the present Kasauli vaccine is 1,389 million followed by 2,778 million, thus giving a total of roughly 4,000 million. So far as our enquiries went in Mesopotamia this vaccine was not known to give rise to any notable reactions local or general. We understand the Millbank vaccine contains a total of 6,000 million organism and we are not aware that this vaccine gives rise to anything remarkable in the way of local or general reactions. The whole question of cholera vaccination generally and of dosage in particular is still *sub judice*. Many authorities have prepared and given without any ill effect a total of 15,000 million organisms in two doses of 5,000 millions and 10,000 millions, respectively. Where cholera inoculation can be systematically carried out every 3 or 4 months the necessity of raising the dosage would probably not arise, but the impracticability of carrying out this comparatively frequent periodical immunization has been demonstrated under service conditions and we are of opinion that if cholera vaccination is to afford any protection at all, it is more likely to do so if the dosage is very materially increased beyond what it is at present. It was arranged that official sanction should be asked for raising the dosage from the total of 4,000 million to one of 12,000 million in two doses of 4,000 and 8,000 million, respectively, and that a trial should be made with this new formula probably at the same time and under the same conditions as the suggested trial with the new T. A. B. formula. Mesopotamian strains of cholera taken by Colonel Ledingham to India are available for future use, but the suggested test might be made with the Kasauli strains at present employed.

It was also arranged that in future the labels on vaccine vials should show the dosage in millions of organisms.

To summarize the points alluded to in the above memorandum—

Official sanction is asked for an immediate trial under the personal direction of Major Brown, of a triple vaccine and a cholera vaccine of increased dosage and modified formula, the trial to take place at some depôt not too far removed from Kasauli, preferably at Lahore. Should the results of those trials prove satisfactory, authority would be required for the preparation of these vaccines on the large scale according to the new suggested formulas.

That for cholera, according to the proposals which are being made by the Committee to the Director, Medical Services (Mesopotamia), would require to be prepared on the large scale at the earliest possible date after the result of the trial had proved it to be satisfactory.

Finally the point was strongly urged by the scientific staff of the Central Research Institute that they should be put in closer touch than they have been hitherto with the authorities in Mesopotamia responsible for the systematic inoculation of the troops, for the indenting of fresh supplies and for the collection of inoculation data. With this strongly expressed desire we are in complete sympathy and we propose to represent to the Director, Medical Services, Mesopotamia, certain suggestions bearing on this and allied questions.

DELHI :
The 27th February 1917.

Appendix VI.

Note on the value of Agglutination tests in the diagnosis of Enterica in individuals previously inoculated with T. A. B. Vaccine. (*Forwarded to Director, Medical Services, Mesopotamia, January 1917.*)

The Committee have, as you will have noticed, frequently recommended the abandonment of agglutination tests in T. A. B. cases and urged the importance of concentrating on isolation of the causative organism from the blood or excreta. It has been suggested that you may find it useful to have a few words in explanation of the reason for this advice, which could be communicated, if desired, to the various bacteriologists in the Mesopotamian area including those at the hospital laboratories.

In advising the abandonment of Widal tests in T. A. B. cases as a general routine measure, we have been strongly impressed by the practical difficulties involved in carrying out a succession of tests in a suspected case over a lengthly period apart altogether from the undoubted liability to error in the interpretation of the results when collected and charted in the approved fashion. Cases of Enterica often remain too short a time in one place to permit the carrying out of an adequate series of careful serum-titrations by one responsible bacteriologist, but even if this were possible amid the multifarious duties of a busy department especially in epidemic times, he would still be faced by the necessity of solving what is frequently a very awkward problem, *viz.*, the interpretation of the mass results for the benefit of the medical officer in charge of the case. The fact is that the carrying out and interpretation of these tests under the new conditions imposed by the triple vaccine, have become a matter of academic research in the hands of experts and can no longer be regarded as practical diagnostic agents in the hurry of war time. A recent paper by Ainley Walker in the *Lancet* of November 25th, 1916, has only tended to confirm rather than to modify our previously expressed opinion on this matter. We would advise the careful perusal of this paper by all bacteriologists as it illustrates the practical difficulties of the method on which we have insisted *viz.*, the necessity of undertaking a long series of titrations (six at least and possibly more) before a sufficiency of data can be amassed on which to found a diagnosis—which may after all be a subject of dispute. Bacteriologists will be also interested in the attempts to diagnose cases coming under bacteriological supervision at a late stage in the disease, when the agglutinin curves are on the fall and stress has to be laid on the rate of fall and other factors. But methods such as these depending on extreme refinements in titration and demanding expert judgment for the final interpretation of the data, cannot be recommended for general use in practical diagnosis.

The advice to be given, therefore, is that the bacteriologist should concentrate as much as possible on methods for the recovery of the organism from the blood and excreta. This should be fully understood at the hospitals and measures should be taken to increase the number of blood samples obtained at the earliest practicable period in the disease.

The Committee of course have no desire whatever to stop any useful research on agglutination methods which might lead to a better understanding of the course of the agglutinins in T. A. B. cases or to the future employment in such cases of agglutination methods on practical lines likely to be of service in the campaign. Any research for this purpose, however, would need to be carefully planned and thoroughly carried out over a considerable series of cases by bacteriologists of experience, apart from the routine requirements of the laboratory. *The cases for study should be those in which the organism has been recovered,* preferably at an early stage in the disease and the successive serum titrations at carefully spaced intervals should be carried to end-points as accurately defined as possible. Opportunities for such research might perhaps be found at the Central Laboratory, Amara, the Central Laboratory, Basrah, or the Laboratory of No 3 British General Hospital, Basrah. The bacteriologists of these laboratories might usefully be invited to report on the practicability of such research work being undertaken there. Comparative information of this character might contribute materially to knowledge and form a solid basis for future advances in the serological diagnosis of enterica.

BASRAH :
January 24th, 1917.

Appendix VII.

REQUIREMENTS OF COOKING AREAS.

The following notes, regarding the construction of temporary shelters and cooking areas for British troops, are taken, with some adaptations, from the Committee's report on the Salonika inquires in May 1916.

The cooking area, whether for large or small units, should comply with the following:—

(*a*) It should be enclosed by a mud or brick wall, or be roped off or railed or surrounded by sheets of canvas or sacking, so as to delimit the whole area, for the cleanliness of which the cooks are responsible, and to reserve that area exclusively for them and for necessary fatigue men.

(*b*) It should include a lean-to shed for the preparation of food, enclosed on three sides, and with the open side facing north. The walls and roof should give as much protection as possible from the sun, and a movable screen of matting should be provided for the open side. The shed must have free top ventilation, *e.g.*, 1 foot of open space all round beneath the eaves. Its interior should be as dark as possible. Its floor should be smooth and hard, sloping towards the open side, so that it can be readily swept or washed down. In the absence of cement or brick, a good floor can be made by mixing damp earth and bhusa, watering and ramming down well on the following day. The shed should have shelving, and fly-proof boxes or cupboards for all food which would otherwise be exposed to flies. The open side of the shed should face the part of the area where the field ovens, travelling cookers, etc., are placed, and for which any practicable head covering should also be provided.

(*c*) The area should include a fixed place, close to the shed, in which temporary refuse-receptacles should stand. These should have fly-proof covers; sacking weighted at the edge serves very well. Grease traps should also be included in the area.

(*d*) There should be a separate fly-proofed place for storing meat and other perishable food. Dug-out larders, with doors of perforated tin plate, are useful for this purpose.

Chopping boards, cupboards, shelving etc., should be kept thoroughly cleansed with hot soda or soap, and the whole of the interior of the shed and of the cooking area generally, must be kept scrupulously clean at all times. Cooks should be given a frequent supply of dish cloths for cleansing food utensils, and these should be frequently washed, and then placed in a disinfecting solution (*e.g.*, bleaching powder). Cooking and table utensils, when they cannot be boiled, should be immersed in a strong solution of washing soda. In every cooking area a place should be reserved for a wash basin (or its equivalent), nail brush, soap and towel. Cooks should wash their hands as a matter of routine after going to the latrine. They should be supplied with overalls. Where the cooking area is unavoidably close to a source of attraction to flies, *e.g.*, horse lines, or a native village, an open air fly-trap may be placed outside the cooking area between it and the source of fly nuisance.

The above points apply just as forcibly to officers' messes as to those of the men.

INDEX TO REPORTS ON MESOPOTAMIA INQUIRIES.

REFERENCES:

B=Report on Basrah Base.
SS=Report on Sheikh Saad.
C=Report on 3rd Indian Army Corps (advanced area).
L=Report on Lines of Communication, Sheikh Saad to Basrah.
E=Report on Euphrates and Karun.
F=Final Report.

NOTE:—Numbers represent paragraphs, not pages.

INDEX TO REPORTS ON MESOPOTAMIA INQUIRIES.

ABLUTION—

Need for ablution places, S.S. 8; at Ahwaz, E. App. III, 14; Facilities to be provided at Amarah, L. App. VII, 11; arrangements required in advanced area, C. 17. Handwashing for cooks and at latrines, B. 33, F. 65.

Useful improvised shower bath, C. 17.

ACKNOWLEDGMENTS—

B. 61, S. S. 2, C. 93, L. 5, 10 and 53, E. 3 and App. III, 1; F. 73 and App. V.

ADMISSION AND DISCHARGE BOOK—

Diagnoses entered in, should be those made in the Hospital, L. App. VII, 4.

AHWAZ—

Report of inspections and inquiries at, E. 10; and E, App. III.

ALI GHARBI—

Report of inspections and inquiries at, L. 8.

AMARAH—

Report of inspections and inquiries at, L, 10—19, and L, Appendices I to VII.

ANÆMIA—

Statistics regarding from Amarah hospitals, L. App. VIII; and Naisriyah, E. App. VI.

ANOPHELES PULCHERRIMUS—

A common mosquito in Base Area, B. 55; not very prevalent in advanced area, C. 49; at Ahwaz, E. App. III, 3; not an intense malaria carrier, F. 49.

ANOPHELES STEPHENSI—

Chief malarial vector in Base Area, B. 55; and in Mesopotamia generally, F. 49.

ANKYLOSTOMIASIS—

In Indian troops, C. 66; ova detected, C. 91.

ARSENITE OF SODA—

Value of, in fly prevention; need for colouring of, C. 47 (*d*).

ASHAR—

Population of, B. 2; Civil sanitation in, B. 45.

ATTA—

Substitution of, for rice, B. 47; new ration scale of, C. 77 and App. III; Apt to deteriorate if stocks accumulate, F. 64.

BACTERIOLOGIST—

Need for, at Isolation Hospital, Basrah, B. 54. Should be in touch with clinicians, B. 55 (*a*); L. App. V; F. 14.

Consultant bacteriologist required at Amarah, L. App. V; necessity for consulting bacteriologist to the Force; duties of, F. 18 and F. App. III.

See also Laboratory.

BACTERIOLOGY—

At the Base, special memorandum on, B. 14; importance of systematising the work in the Basrah Area, B. 55 (*a*);

Facilities, requirements and organisation in Base Area, B. 58; at Sheikh Saad, S. S. 20, L. 27; in advanced area, C. 86, 87; at Amarah, L. App. V; no facilities for, at Ahwaz, E. App. III, 12;

Improvised receptacles for stool samples, C. 89.

BAKERIES—

In advanced area; need for adequate shelter, C. 32; Heat stroke amongst bakers, L. App. VI, 5.

BALANTIDIUM COLI—

Infection with, C. 91.

BASE AREA AND BASRAH—

Report on inspections and inquiries at, B. Later developments at, F. 6; need for strong sanitary organisation, B. 19, F. 26.

BERI-BERI—

In British troops, intended use of "marmite" for, C. 59; outbreak at Shaiba, nature and possible causes of, F. 60.

BERI-BERI—*concld.*

Statistics regarding, from Amarah hospitals, L. App. VIII; for whole force, August to December 1916, F. App. II.

BILLETS—

In Base Area. Importance of control and supervision, B. 32.

BILHARZIASIS—

Occurrence of amongst native population in Euphrates area, advisability of search for snail hosts of the parasites, E. App. I, 8.

BORINGS—

Deep well boring at Basrah, beginning only made, B. 29; suggested for Ess Sinn Area, C. 15.

BREAD—

Excellent quality of, in advanced area, C. 32.

BRITISH ADVANCED DEPÔT—

Amarah. Excellent condition of, L. 16.

CAMPS—

Basrah, difficulties of sites, B. 30, Medical reinforcements and other camps B. 14, 30. *Amara*, 13th Division inspection of, L. 20 and App. VI; 72nd Field Company, R.E., bad sanitary condition of, L. App. II. Environments need sanitary attention, L. 16. *Nasariyah*, generally good, insanitary state of Artillery Camp, E. App. I, 16. *Sheikh Saad*, generally good, S. S. 4, insanitary area, S. S. 6. L. 7; *Advanced Area*, sites good and sanitary arrangements satisfactory, C. 21; ; for marching echel on Tigris; sanitation unsatisfactory, requirements; L. 24.

CATTLE—

Disease of, at Ali Gharbi L. 9.

CENTRAL DISINFECTING—

Station required at Base Area, B. 48; station at Arab Village, C. 19.

CEREBRO-SPINAL FEVER—

Prevalence, serum treatment, and prevention; suggested leaflets, F. 48. Statistics July—December 1916, F. App. II.

CESS-PITS—

Of native type might be used for Municipal conservancy, L. App. VII., E. App. I, 26.

CHAPATTIES—

Waste of; C. 77.

CHLORINATION—

Of water supplies at Basrah, B. 27; control and supervision of, special officer required, B. 28; at Sheikh Saad should be controlled by iodide test, S. S. 11; in advanced area, methods employed, C. 4; Nelson-Treherne method, C. 7; at Amarah, quantity bleaching powder used, L. 11, should not be diminished for soda water, L. 11; at Nasiriyah needed improvement, E. App. I. 9.

Has been systematised, general routine now adopted, F. 68. Provided for in mechanical filtration plants F. 68.

CHOLERA—

Statistics regarding, from Basrah hospitals, B. 7; from Amarah hospitals, L. Appendices. VI and VIII; for whole force 1916, F. App. II.

In Basrah, B. 9; at Sheik Saad, S. S. 13; in 3rd I. A. C., attributable to water-borne infection, C. 54; effectively dealt with by water chlorination, C. 55.

Sporadic cases of, L. 3; causes of general reduction in, F. 31.

Question of subsidiary cholera hospital for Basrah, B. 54.

Inoculation, progress of, F. 5; in labour and porter corps, F. 31; general reinoculation recommended early in 1917; with vaccine of increased strength, F. 32, 34 and App. V.

CIVIL DISPENSARY—

At Ali Gharbi, Amara and Kurna, good work done at, L. 8 and 51. Recommendations regarding, at Ahwaz, E. App. III. 17.

CIVIL DISPENSARIES—

Military value as giving information as to local infections, L. 51.

CLAYTON DISINFECTORS—

Recommended for Base Area, B. 48; for Advanced Area, C. 19; for use at Amara, L. App. VII, 11.

CLOTHING—

Serge recommended for cold weather, C. 34. Spare puttees as abdominal belt, C. 34.

COCUM—

Ration scale of—C. 85.

COLITIS—

Statistics regarding—from hospitals at Basrah, B. 7; at Amarah, L. App. VIII; at Nasiriyah, E. App. VI.
A term to be deprecated when applied to mild bacillary dysentery, L. 34.

CONSERVANCY—

In Base Area, B. 33, *et seq.*; in Advanced Area, C. 36; at Amara, proposed sanitary tramway, L. 12; at Nasiriyah, E. App. I, 13.
Description of oil pit for excreta, L. App. VII.

CONVALESCENT DEPÔTS—

British and Indian at Muhammerah, both excellent, E. App. IV.

CONSULTANT—

For tropical diseases, necessity for—at Amara, L. 18.

COOKING, COOKHOUSES, AND COOKS—

In Advanced Area, C. 26, 30; need for field cookers, C. 28 and L. 20; to be supplied, F. 65.
Cooking utensils for Indian troops: reserve supply recommended for individual issue, F. 59. Absence of —may predispose to bowel complaints; F. 66. Oil-drip cooking for Indian troops, E. 12 and App. V.
Great necessity for good cooking arrangements, F. 65; instruction at Base should be pressed, F. 65.
Desiderata for good camp kitchens, B. 38; sanitary requirements of cookhouses and cooking areas, F. 65 and App. VII; use of mud-brick in construction of, C. 26; shelters for Indian units suggested, F. 66.
Cooks should have dish cloths, washing soda, and facilities for hand washing, C. 29, F., 65 and App. VII.
Enterica and dysentery convalescents should not be employed as cooks, F. 67.

CORPS AREA—

Report on inspections and inquiries in area occupied by 3rd Indian Army Corps,—C.

DEBILITY—

Statistics regarding—from Basrah hospitals, B. 7; from Amara App. VII.; Nasiriyah E. App. VI.

DENTISTS—

Shortage of, especially at Amara L. App. IV.

DHALL—

C. 69. See rations.

DIARRHŒA—

Statistics regarding—from Basrah hospitals; Amara, L. App. VIII; Nasiriyah, E. App. VI.
Prevalence of—in Base Area, B. 8 and 56; at Ahwaz, E. App. III, 8.
Value of special wards for—L. 35.

DIPHTHERIA—

At Gurmat Ali and Sheikh Saad, S. S. 5; outbreak in 2nd Norfolks, S. S. 14.

DISINFECTANTS—

Stock disinfectants used; shortages should be made up, C. 20.

DISINFECTION—

Improvised disinfectors with current steam suggested for work on large scale, B 48; generally should be more used, F. 69.
Lack of facilities at Base Area, B. 48; at Amara, L. App. VII, 11; at Ahwaz, E. App. III, 4; suggestions for—at Sheikh Saad, S. S. 12; in advanced area, portable disinfector on river barge suggested.
Railway disinfecting vans suggested, C. 19, E. 7, and App. I. 19; now to be supplied from India, F. 69.

DIET—

See Rations; also Scurvy, C. 59-60 and 69 *et seq.*

DRAINAGE—

Of surface water at Amara, L. App. III. Progress of drainage works, F. 6 (*f*).

DUG-OUTS—

As dwellings in hot weather, C. 22; for storing meat, C. 27.

DYSENTERY—

Statistics regarding—from hospitals at Basra, B. 6, 7; at Amara, L. App. VIII; at Nasiriyah, E. App. VI; for whole force, August-December 1916, F. App. II.
Prevalence of in Base Area, B. 8; at Sheikh Saad, need for supply of curative serum, S. S. 18; in advanced area, C. 64; at Nasiriyah, probably fly-borne infection from faulty incineration, etc., E. App. I, 2; at Ahwaz, E. App. III, 8.
A very serious factor of sickness, F. 44; relation to defective field sanitation, F. 44.
Memoranda on for hospital medical officers, L. App. I. A.
Special investigation initiated by Committee in Base Area, B. 56; its results, F. 43 and App. IV.
Amoebic, proper treatment of B. 56; F. 49; indiscriminate use of emetin in, B. 56, S. S. 18, faulty treatment of, in Base Area, need for more accurate diagnosis, B. 56; healthy and convalescent carriers, F. 47; general campaign against amœbic and flagellate carriers impracticable, F. 47.
Bacillary, specific and non-specific treatment of, B. 56, L. App. I, A.; value of early serum treatment in, F. 46. Bacillary probably the more common type in Base area B. 56; in advanced Area, C. 91: at Amara, L. App. V.; in Mesopotamia generally, F. 43. Predominance of B. Shiga infection, F., 43 and App. IV.
Mild bacillary often returned as "Colitis," L. 34.
Acute, need for microscopical examination of excreta before treatment, L. App. I. A.
Method for selection and dispatch of samples of excreta to laboratory, L. App. I. A.; C. 89; Cultural examination of dysentery stools, L. App. I. A.
Avoidance of infection in hospitals, L. App. I. B.
Treatment generally, recent improvement; need for differential observations, F., 45. Anti-bacillary vaccine, supply to be considered, F. 46.

EFFECTS OF HEAT—

Statistics regarding—from Basrah hospitals, B. 6, 7; Amara, L. App. VIII; Nasiriyah, E. App. VI; for whole force July-December 1916, F. App. II.
Great prevalence and conditions predisposing to, C. 57; lowering resistance to disease and retarding convalescence C. 58. Ample supply of drinking water as a prophylactic against, F. 63.
Greater in drafts fresh from England and on young soldiers, C. 58. Recommendation, C. 92. Action taken, F. 7; in 13th Division, L. App. VI.
See also Heat Stroke.

ENTAMOEBA HISTOLYTICA—

C. 91, F. 47. See Dysentery.

ENTERICA—

Statistics regarding—from hospitals at Basrah, B. 7; at Amarah, L. App. VIII: at Nasiriyah, E. App. VI: for whole force, August to December 1916, F. App. II; figures underestimate F. 3, 37.
In Base Area, with analysis of cases in relation to inoculation, B. 55 (*a*); in advanced area, C. 64; at Sheikh Saad, S. S. 17; at Nasiriyah—probably fly-borne infection, E. App. I, 2.
Improved measures for notification, taken or still required, C. 65; diseases commonly mistaken for, F. 37.

ENTERICA—*concld.*

Carrier cases, figures as to, F. 39 ; recommendation as to examination for carriers in India, F. 41.

Paratyphoid A much the most common form of, F. 37 ; Laboratory diagnosis — necessity for blood culture ; Widal test better abandoned in cases after T. A. B. inoculation, B. 55 A., L. 36, App. V., F. 40 and App. VI.

Inoculation against, suggested general re-inoculation and change of T. A. B vaccine F. 38, 39 and App. V.

ENTERITIS—

Statistics regarding — from hospitals at Basrah, B. 6,7 ; at Amara L. App. VIII ; at Nasiriyah, E. App. VI.

Production of — by wrong rations or bad cooking, B. 47 ; F. 66.

FIELD COOKERS—

See cooking.

FIELD AMBULANCES—

Very good generally, requirements of - for cold and hot weather, C. 23.

FILTRATION—

Pressure filters if used should be supplemented by storage, or chlorination, B. 29 ; F. 68 ; Ransome water filter for Nasiriyah, E. App. I, 10.

Filtration barges expected, L. 23 (*c*) ; F. 68.

See also Water Supply.

FISH—

No general use of Tigris fish for rations, but individual fishing, C. 69 (2).

Larvivorous—use of as an anti-mosquito measure, F.51.

FISH NETTING—

Useful for excluding flies, L. 48.

FLEAS—

Methods for dealing with, E. App. II, 1.

FLIES—

In latrines at Basrah, B. 33 ; protection of food from, C. 30 (See also Cook houses) ; prevention of—in latrines, C. 37 ; Rôle of—as disease carriers, organization of campaign against, C. 45 ; source of in advanced area, C. 40, 46 ; at Amara, L. 20 ; instruction regarding, C. 47 (*b*). Disappearance of in very hot weather, C. 56.

Scattered faecal deposits as nurseries for, L. 47. Fish netting for exclusion of—from tents, etc., L. 48. Decrease in number of—with advent of cold weather, importance of spring campaign against, L. 50 ; constitution of "fly brigades", C. 47 (c).

FLY EXPERTS—

Necessity for commissioned rank for, C. 47 ; now recognised, F. 5 (*a*) ; full use should be made of — four probably required, C. 47 (*a*) ; at Amara, duties of — instructions by — work of should be systematised, L. App. VII, 10 ; F. 19.

FLY TRAPS—

Open air type B. 39, C. 47 (*e*) ; should conform to pattern and be under special supervision, L. 49.

FOLLOWERS—

Statistics of sickness, F. App. II ; collection and examination of—in India, F. 7 ; Rations, C., 76 and App. III ; in Bombay camps deficient in anti-scorbutics, F. 54.

FOOD—

Need for strict control over locally purchased food and drink in Base Area, B. 47 ; at Amara, L. App. VII, 9.

Preservation of perishable foodstuffs, B. 47, F. 58 ; under-ground storage of - in hot weather, C. 27.

Development of local food supplies, L. 40, F. 6 (*c*).

Supplies, in Base Area, B. 47 ; now generally good, F. 64.

Deficiency diseases, C. 59, F. 60.

FOOD—*concld.*

Importance of good and well cooked food to efficiency, F. 65.

See also Cooking, Rations, Scurvy.

FOOD UTENSILS—

Cleaning of, importance for avoidance of infection — B. 40 ; C. 25, L. App. VI, 2 ; F., 65 and App. VII.

FRUIT—

Cleansing of—prior to issue to troops, B. 47. Difficulties of supply, C. 69 (3).

FUEL—

Shortage in and allowances of, C. 69 (5), C. 78 ; E. 12; F. 58.

See also Rations.

GARDENS—

For supply of vegetables at Amara, L. 17 ; L. 40 ; at Ahwaz, E. App. III, 17 ; recent developmens, F. 58.

GHI—

Allowance small for winter months, C. 79 ; complaints as to quality and adulteration, C. 79 ; L. 41.

See also Rations.

GUR—

Allowance of and substitution for meat, C. 80 and App. III ; not a physiological substitute, C. 80 ; proposal to replace gur by sugar, C. 80 and F. 64.

HAKIKA—

Sanitary condition of, E. App. II, 1.

HEAT STROKE—

Water posts in Basrah Area — value of — B. 46 ; In advanced Area, C. 57.

Good protection against—now given on river steamers and barges, F. 62 ; required for patients awaiting embarkation, F. 62.

Information as to treatment, etc., to be distributed to medical officers, F. 61 ; in 13th Division ; use of spirit in lieu of ice for cooling purposes, L. App. VI ; Treatment of asphyxial form by artificial respiration, E. App. I, 7.

See also Effects of Heat.

HELMETS—

Sometimes of poor quality ; importance of reserve supply of good helmets, L. App. VI.

HORSFALL DESTRUCTORS—

At Base Area, B. 34.

HORNETS—

As possible carriers of infection, B. 33.

HORSE MANURE—

Disposal of—ridge method ; open cone incinerator ; method of stacking and coating with sand and oil ; burning in pits, C. 41 ; B. 34, L. App. VI, 4.

Roubaud's method of dealing with—E. App. I, 13.

See also Incinerators.

HOSPITALS—

At Base Area, B. 49 *et seq.*; at Sheikh Saad S. S. 19 ; at Amara, requirements of isolation hospital, L. 17, App. IV ; at Ahwaz, personnel required strengthening, E. App. III 2, 10 ; at Nasiriyah, E. App. I, 21, 23.

Analysis of admissions to general hospitals, B. 7 ; L. App. VIII ; E. App. III, 3.

Deficiency in records and notes — suggestions, B. 59 ; L. 32.

Isolation hospital at Base, site, accommodation, laboratory facilities, accessibility, improvements and suggestions, B. 54.

General satisfactory development of and improvements in—F. 5, 9.

HOSPITAL NOTES—

Should be sent on with patients, L. 31 ; often defective, L. 32 ; great importance of—in dysentery and enterica cases, L. 32.

HOSPITAL NOTES—*contd.*

Documents which should accompany transfer cases, L. App. VII, 5 ; to convalescent depôts, E. App. IV, 1 ; and sent on to India, F. 42.

HUTTING—

Increase of hutting for troops, F. 6 (*d*) ; E. App. III, 10 ; C. 22.

Necessity for mess huts in Base Area and Ashar Barracks, B. 31.

For hospitals, requirements and nature, at Amara, L. App. IV ; general increase in, F. 9.

ICE—

Requirements for hot weather, C. 33.

See also Heat Stroke.

INDIAN SANITARY SECTIONS—

Require adequate transport —C. 43.

INCINERATION—

In Sannaiyet trenches and in advanced area generally, C. 36 ; at Nasiriyah, E. App. I, 13 ; at Amara hospitals, L. App. IV, 3.

Danger of leaving excreta exposed to flies before incineration, L., 12, and App, IV, 3 ; E. 13, and App. I, 2.

Of refuse in advanced area, C. 40.

INCINERATOR—

Open type with special covers, C. 40.

Open cone incinerator useful for litter, B. 34 ; C. 41 ; L. 8, 26, and App. VI ; E. App. III, 15. Grid type for litter, B. 34. Type in use at Base Area, suggested improvements for—B. 34 ; in Corps Area closed incinerators of mud or mud brick C. 39 ; as source of hot water supply, C. 17 ; at Amara, sugarloaf type, L. 12 ; sweepers should be housed near them, E App. I, 14.

Shortage of incinerator bars should be met, C. 39.

INFECTION—

Spread of—in hospitals. Memorandum by the Committee. L. App. I (*b*).

See also under special headings.

INFECTIOUS DISEASE—

Notification of civil cases in Basrah.—B. 45. ; risks of—from civil population on Karun Front, E. App. III, 17.

INOCULATION—

Against cholera ; protection afforded ; reinoculation in spring advised ; increase in strength of vaccine, F.-32, 34, App. V.

Against enterica ; recommendations for reinoculation, and suggested change in T. A. B. vaccine F.-39 and App. V.; Records of, in enterica cases, B.-55, A.; need for information *re* efficiency of T. A. B. vaccine, L. App. V, and App. VII ; F. 18.

T. A. B. inoculation needed at Shaik Saad, S. S. 17 ; at Ahwaz, E. App. III, 2 ; general position at close of 1916, F. 5 (*d*).

Entries in paybooks regarding, L. App. VII, (1) ; suggested improved method, F. 33.

JAUNDICE—

Statistics regarding—from hospitals at Basrah, B. 7 ; at Amarah, L. App. VIII ; at Nasiriyah, E. App. VI. ; epidemic of, in 13th Division, L. App. VI ; at Ahwaz, of benign nature, E. App. III, 5 ; more information and laboratory work required, L. App. V, and E. App. I, 24.

JUNCTION CAMP—

Sanitary condition of, E. App. II, 3.

KASAULI—

Central Research Institute, preparation of vaccines at—visit and report, F. App. V.

KARUN FORCE—

Report on inspections and inquiries, E., 10 and App. I.

KITCHENS—

See Cookhouses.

KURNA—

Report on inspections and inquiries at, L. 21-23.

LABORATORIES—

Necessity for good laboratory at Isolation Hospital, Basrah, B. 54 ; need for—at Shaik Saad, S S. 20, C. 90 ; now established—L. 27 ; Laboratory barge, C. 86 ; necessity for strengthening personnel, C. 88 ; shortage of requirements in advanced Area, C. 89.

Basrah Central Laboratory, L 4 ; F. 19.

Inspections of—at Amarah, L. 30 ; Amarah Central Laboratory, L. App. V; demonstrations by the Committee at Amara, L. 30 and App. V.

Co-ordination of laboratory work on L. of C., L. 30 and App. V.

At Nasiriyah, shortage of equipment, E. App. I, 24 ; none at Ahwaz, facilities required, F. App. III, 12.

Stores and equipment, general considerations regarding ; co-operation with India, F. 70, App. III.

Clinical—at Amarah, L. App. V.

Recent changes in—F. 5 (*c*).

LAMBLIA—

Infections with, C. 91, F. 47.

LARDER—

Underground type for hot weather, C. 27 ; small fly proof types useful, C. 30.

LATRINES—

In Base Area, faulty conditions of—B. 33 ; ablution place for hand washing in connection with : B. 33 ; boarded pit latrines for temporary use, B. 33, C. 38. Good Indian type, B. 33 ; type for redoubts, S. S. 22 ; British and Indian in advanced Area ; fly prevention in ; use of sacking as covers in Indian latrines, C. 37 ; trench latrines, C. 38 ; at Nasiriyah, type of covers for and supply of toilet paper in—E. App. I, 13 ; at Ahwaz, improvements suggested, E. App. III, 15.

See also Sweepers.

LEAVE—

Scheme, general, for hot weather ; importance of "preventive" or "recuperative" leave, E. 11 ; F. 7.

LEISHMANIA TROPICA—

See Oriental Sore.

LICE—

In advanced area, C. 19, 49 ; amongst labour and porter corps, S. S. 12. Soap and Kerosene emulsion F. 69.

See also Disinfection.

LIGHTING—

Of camps in advanced area, C. 24.

LIME JUICE—

Complaints of "old" lime-juice on ground of taste and appearance ; considered of little value as anti-scorbutic ; inquiries in India desirable, C. 84.

New lime-juice from fresh limes to be made, C. 84 ; now supplied, F. 48 ; recommended for winter issue to Indians, C. 84.

LIVER ABSCESS—

Statistics regarding—from Amara hospitals, L. App. VIII, and Nasiriyah, E. App. VI.

MALARIA—

Statistics regarding—from hospitals at Basrah, B. 6. 7 ; at Amara, L. App. VIII ; at Nasiriyah, F, App. VI ; for whole force August-December 1916, F. App. II.

Prevalence of—F. 49 ; at Basrah, B. 45, B. 55 (*a*) ; F. 49 ; seasonal incidence of—E. 10, F. 50 ; measures of prevention required for 1917, and their urgency, F. 51 ; include malaria investigation officer, F. 51.

Danger of borrow pits, S. S. 16 ; L.App. VII 8, E App. I, 3.

MALARIA—*concld.*

In advanced area, C. 66; at Kurna, prevalent among troops though spleen index moderate, L. 23; anti-malarial work required at Kurna, systematised quinine prophylaxis, use of nets, spraying for mosquitoes, L. 23.
Intensive treatment of—under certain conditions, L. 37.
Frequency of relapses and their prevention. Post-malarial treatment unsatisfactory; recommendations —L. 37, E. App. I, 4 and App. IV, 2, F. 52, 53.
Treatment of convalescents at Muhammerah inadequate, E. App. IV.
Anti-malarial work at Amara, L. App. VII; at Nasiriyah, E. App. I, 3.
See also Mosquitoes, Quinine.

MARCHING POSTS—

On Tigris, importance of—from a sanitary standpoint, L. 24, L. 25; recommendations L. 26.

MEAT—

Supply for Indian troops, C. 69 (2); new scale C. 81; Indian allowance should not be stereotyped, C. 81; improvement in supply of—C. 71; supply of frozen meat for British troops, F. 64.
See also Rations.

MEDICAL ADMINISTRATION—

General review of, and suggestions regarding—F. 9 *et seq.*; use of medical experts, F. 19; development of intelligence system, F. 20.

MEDICAL OFFICERS—

Selection of—for Mesopotamia, F. 28, 29; should be encouraged to bring microscopes, etc., F. 30.

MEDICAL REINFORCEMENTS CAMP—

Special memorandum on; site bad and conditions faulty, B. 14; should be moved to another site, B. 30.

MEDICAL STORES—

Inspection of, at Amara, L. App. IV; laboratory materials at—F. 70 and App. III.

MESSING HUTS AND SHELTERS—

Sanitary value of—C. 25, F. 65.

METEOROLOGY—

Maximum and minimum temperatures at Basrah, F. App. II.

MICROSCOPES—

Required for field ambulances, E. App. I, 25; for Convalescent Depôts, E. App. IV; for Ahwaz, E. App. III, 12.

MILK—

Supply to Indian troops, C. 69, (4); tinned sweetened condensed milk should be reserved for Indians as far as possible, C. 83.
See also Rations.

MOSQUITOES—

In Base Area, breeding places; anophelines; anti-mosquito measures required in 1917, B. 55, F. 49-51; at Kurna also, L. 23, F. 49-51.
Influence of larvivorous fish on—B. 55, use of, F. 51. Borrow-pits as breeding place of—S. S. 16; E. App. I. 3; L. App. VII, 8; Few in Corps Area, C. 49; at Nasiriyah, E. App. III, 3. Spraying for—recommended at Kurna, L. 23; composition of spray, F. 51; anti-mosquito measures needed at Amara; "mosquito brigade", L. App. VII; use of trap-pools, L. App. VII, 8 and F. 51.
See also Anopheles, Malaria.

MOSQUITO LARVAE—

Conditions unfavourable to—in Base Area, B. 55.

MOSQUITO NETS—

Use of in Base Area—size of mesh needed, B. 55; inspections and repair of—F. 51.

MUHAMMERAH—

Convalescent Depôts at, inspection of—E. App. IV.

NASIRIYAH—

Report on inspections and inquiries at—E. 3-9 and App. I.

ORIENTAL SORE—

In Corps Area, C. 66; cases of—detected at Nasiriyah, E. 5 and App. I, 5; supposed cases at Ahwaz, E App. III, 7; protection of—from flies, E. App I, 5.
Memorandum by the Committee on—E., 5 and App. VII.

OIL-DRIP COOKING—

Suggested for use of Indian troops, description of method, E., 12 and App. V.

OIL-PITS—

For excreta, description of—L. App. VII, 7.

PARATYPHOID FEVER—

See Enterica.

PHLEBOTOMUS—

See Sand-flies.

PIPES-WATER—

Should be laid at least 2 feet underground on account of heat, E. App. I, II. Improvised, B. 37.
See Water-Supplies.

PLAGUE—

In Base Area, F. 35 and App. II; measures against rats in Bombay docks, F. 35.

POLYNEURITIS—

See Beri-beri.

POPULATION—

Civil—of Base Area, September 1916, B. 2.

PORT MEDICAL OFFICER—

At Basrah, B. 18.

POTATOES—

Supply available since October, C. 71; F. 58; in British and Indian rations, C. 82

PREVENTION OF DISEASE—

See Medical Administration, Sanitation.

PRINTING—

Greater use should be made of—in sanitary work, F. 20; leaflets *re* infectious disease suggested, F. 48.

PROTOZOOLOGY—

Suggested instruction in, on L. of C., L. 29. Infections found in advanced area, C. 91.
See Entamœba and special headings.

PUMPS—

For local water supply, type in use liable to get out of order, C. 9; for flood water at Ali Gharbi, L. 8.

PUMPING—

Of surface water at Amara, L. App. III.

PUTTEES—

A new type of unsuitable quality, C. 34.
See Clothing.

PYORRHŒA—

Severe cases of—C. 68 (*d*); its relation to scurvy and treatment at 42 I. G. H.—L. 39, F. 53.

"P. U. O."—

Statistics regarding—from hospitals at Basrah. B. 7; in advanced area C. 64; Amara, L. App. VIII; Nasiriyah, E. App. VI; Ahwaz, E. App. III. 11; for whole force, August-December 1916, F. App. II.

QUININE—

Prophylaxis in Base Area—necessity for systematising administration of—B. 55; special officer required, F. 51; dosage required, F. 51.
Therapy after malarial attacks for prevention of relapses, L. 37, E. App. I.-4, and App. IV, 2.
See also Malaria.

RATIONS—

Some faulty conditions noted, B. 47. Good in advanced area, for British troops, C. 60. For Indian troops, and their relation to scurvy, C. 69 (2).
Scale for Indian troops, C. 76 to 85 and App. III.
Indian, necessity for supervision of issue and utilisation of, L., 38 and App. VII; E. App. I, 20.
For garrisons of marching posts require attention. L. 26 (f); usually good on L. of C., L. 40; temporary deficiencies, L. 38; at Ahwaz satisfactory, E. App. III, 16; general position at end of year, F. 64.
Of followers in Camp at Bombay, anti-scorbutics needed, F. 54; free ration for troops in India, allowance in lieu, F. 54.

RATION STRENGTHS—

Should be communicated to A. D's., M. S—S.S. 15.

REFUSE DISPOSAL—

See Conservancy and incineration.

RED CROSS—

Excellent work of, suggestion *re* Commissioner visiting advanced area, C. 35.

RICE—

B. 47; C. 77; winter scale, C. App. III.

ROADS—

Oiling to prevent dust in special cases, B. 44.

ROUBAUD'S METHOD—

Of fly prevention, E. App. I, 13.

RUM RATION—

Might be issued under authority of S. M. O.—L. 42.

SAND-FLIES—

A great pest in Corps Area; possible vectors of *L. tropica*; use of "vermijelli" for destruction of, trapping of—C. 48; "vermijelli" as a sandfly repellant—recommended as a ration issue, L. App., VI.

SANDFLY FEVER—

Statistics regarding—from hospitals at Basrah, B. 7; Amara, L. App. VIII; Nasiriyah, E. App. VI.
At Basrah, B. 8; in advanced area, C. 62; in Ahwaz, E. App, III, 3.

SANITATION—

Progress and requirements of—B. 15; C. 3; L. 4; E. 3 general review, F. 3-8.
Organisation of—in Corps area C. 50; recommendations as to future developments in the force, including D. D., M. S., Sanitary, inspecting staff, unit sanitation, etc., F. 9-25; at the base and important centres F. 26.
Should have fuller recognition in matters of promotion, &c. F. 27.
Importance of constant attention to detail and sanitary discipline, L. 6; influence of O's C. and Commandants on, B. 19; L. 5; F. 25.
Of boats and steamers, L. App. VII, 9; F. 5 (*b*); of marching posts L. 25.
Sanitary demonstration centre established at Basrah, F. 24.
Municipal; at Basrah and Ashar, B. 45; at Amara, L. 15 and App. VII; at Kurna L. 23; at Nasiriyah, E. App. I, 26.

"SANITARY AREAS"—

Of camps in advanced area, C. 36; requirements for—in wet weather, C. 42; of marching posts should be defined, L. 26

SANITARY INSPECTOR—

British—required for municipal work at Amara, L App. VII, 7; at Nasiriyah, E. App. I, 29.

SANITARY INSPECTORS—

Importance of making them mobile, B. 18.

SANITARY SECTIONS—

Clerical assistance for—B. 18; at Sheikh Saad duties of—S. S. 8; organization in advanced area. October 1916, C. 2 and App. II; new sections at Amarah and Sheikh Saad and their organization, L. 4; L. 13 and App. VII; proposed increase of at Kurna, L. 23; changes suggested at Nasiriyah, E. 8.

SANITARY SECTIONS—*contd.*

Increase in number of—and present distribution, F. 5 (*a*).

"SANITARY TRAMWAY"—

For Amara, L., 12 and App. III.

SCABIES—

Sulphur fumigation cabinets for—B. 48; should be used for Indian cases at Nasiriyah, E. App. I, 6.

SCURVY—

At the base, mainly cases from the front, B 57; at Sheikh Saad, local admissions July—October, S. S-15; severe epidemic in advanced area. C. 67, 68; comparatively few cases arising on L. of C., L. 38; contrast of Tigris and Euphrates fronts, E. 4; occurrence at Ahwaz, E. App. VIII; at Nasiriyah, E. App. VI; for whole force, August to December, F. App. II.
British cases none or negligible, C. 59, F. 60; Indian cases very numerous, C. 61: figures increased by special medical examinations, C. 68 (*b*); relation to pyrrohœa, C. 68 (*c*); F. 53; definite cases must return India, C 68 (*c*).
Relation to diet, C. 69 (1); to meat supply, C. 71; self-induced, not a great factor, C. 75; preventive measures taken and causes of diminution after October, C. 68 (*h*), 70; observation camp, 7th Division, C. 74.
Principles governing prevention, F. 54; outlook for 1917 hopeful, F. 58.
Incidence on new drafts, C. 73, F. 53, 55; relation to length of stay in Mesopotamia, F. 56; premature return of men invalided for, F. 55.

SHEIKH SAAD—

Report on inspections and enquiries at—S. S.; subsequent sanitary progress at, L. 7.

SHOWER BATHS—

Simple type of—C. 17.

SICKNESS AND GENERAL SICKNESS RATES—

In Base Area, B. 5; in relation to climatic conditions, B. 12; in advanced area, C. 52-66; earlier records meagre, C 52; cold and hot weather prevalence, C. 53; late summer and autumn prevalence, C. 62; improvement with advent of cold weather, L. 3; prospect for 1917, F. 4.
General rates for each week of 1916, F. App. II. Total as compared with wounded, F. 3.

SITES—

For camps and huts at Basrah—difficulties experienced land reclamation and bunding, B. 30; progress made F. 6; difficulties at Sheikh Saad, S. S. 3; at Kurna L. 21-22 at Ali Gharbi L. 8.

SLAUGHTER HOUSES—

In Base Area. Good arrangements at Makina Camp, B. 43; in advanced area, C. 31: disposal of offal and hides, C. 31.

Little nuisance from slaughtering in the open, C. 31; advantage of central slaughtering places for Indian troops, C. 31 and 71.

SMALLPOX—

Prevalence of—at Ahwaz and in Persian towns, Karun Front, E. App III, 4; figures for whole force July—December, F. App. II.

SOAP—

Importance of full ration of, C. 18.

SODA WATER—

Field Ambulance plants, C. 33; chlorination of, L. 11

STATISTICS—

Weekly statistics of infectious diseases, should be issued to A. D.'s M. S., C 65; F. 20.
Importance of information *re* civil deaths, E. App. I, 27
See Sickness and Special Diseases.

SUGAR—

Preferred by Indians to gur; suggested issue of, C. 80; proposed to issue, F. 64.

SULLAGE AND SURFACE WATER—

Disposal of—in Base Area, B. 36; Amarah, L. App. III.

SUK—

Sanitary condition of—E. App. II, 2.

SWEEPERS—

Supply of—in Base Area, B. 43; necessity for permanent establishments, B. 42; alleged deficiencies in personnel, C. 44: position of whole question in November satisfactory, L. 43-44; unit establishments sufficient if properly employed, L. 44; local reserves in excess of establishment desirable in certain cases, L. 45.

Should be limited to their proper work, L. 44 and App. VI (1).

Supervision of work in of hospitals, L. App. I, B.

TAMARIND—

C. 85. See Rations.

TENTS—

Single fly in hot weather, C. 57; now better provision double fly, F. 6 (*d*).

Pitching of, over excavations to secure coolness, L App. IV; roofing of, with *chatai* for hot weather, L. App. IV.

TETRAMITUS—

Infection with, C. 91; F. 47,

TRANSPORT—

General marked improvement in—beneficial to sanitation, L. 5, F. 6.

Of sick, great progress made, F. 5.

Of vegetables from Amarah up-river—necessity for special vessels, L. 40; now supplied F. 58.

Greater facilities required by Indian Sanitary Sections, C. 43.

TROPICAL DISEASES—

Necessity for consultant on—at Amarah, L. 18.

Need for training in—at Amarah, L. 18; importance of securing medical officers with knowledge of, F. 29.

TRICHOMONAS—

Infection with—C. 91; F. 47

URINE—

Disposal of—at Amarah, L. App. III; at Base Area, B. 35; suggested use of sawdust trough, B. 35.

VACCINATION—

Importance of rules as to scarification, inspection and record of results, E. App. III, 4.

VACCINE LYMPH—

Failures of—and importance of cold storage in transit from India, L. App. V; E. App. III 4; F. 36.

VEGETABLES—

Supply of fresh vegetables to Indian troops, deficient in advanced area during summer, causes of deficiency, C. 69 (3); ration allowance should not be stereotyped, C. 81; production and purchase of—at Amara, L. 40; improved supply and transport of—F. 58.

See also Rations.

VELDT SORES—

Apt to be mistaken for Oriental Sores, C. 66.

"VERMIJELLI"—

C. 48; See Sand-flies, Lise.

VETERINARY—

Epidemic amongst ration cattle at Ali Gharbi, L. 9.

WAR DIARIES—

Recommended to be kept by sanitary officers, F. 71; useful for water work, C. 7.

WATER CARRIAGE—

Advantage of water carts for regimental use, L. App VI; carriage in advanced area, from chlorinating centre, and its risks C. 11.

WATER—

In advanced area, treatment and suggestions *re* precipitation, C. 4; daily supply, C. 13; shallow wells at Dujailah and Imam-el-Mansour, C. 14.

Sterilization of—by sodium sulphate tablets, C. 55; and L. App. VI; E. App. I, 12.

Chemical treatment of—see Chlorination. General system followed, F. 68.

Supply considered from physiological standpoint, F. 63 value of drinking posts, B. 46.

WATER DIGGIES—

Improvements in type desirable, C. 13.

WATER STORAGE—

Protection of water tanks from the sun, B. 37.

WATER SUPPLIES—

Of Base Area, B. 22-29, F. 6 (*e*); Shaikh Saad, S. S. 9-11 and L. 7; Corps Area, C. 4-16; Amara L. 11 and App. IV; Kurna, L. 23; Nasiriyah, E. App. I, 9-10; Ahwaz, E. App. III 13; marching posts, L. 26.

Tanks S. S. 10, tarpaulin, C. 8; rubber canvas better, C. 8.

Dangers of open cuts and channels, C. 7.

See also Chlorination, Filtration, Wells.

WELLS—

Question of deep well borings at Basrah, B. 29.

At Amarah and Nasiriyah, by side of river, L. 11, E. App. I, 9.

Shallow wells in Ess Sin Area, C. 14; at Shaiba, salts in solution, F. 60.

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